COASTAL ZONE PERMIT APPLICATION

Diamond State Generation Partners, LLC

Red Lion Energy Center Project

November 11, 2011

Bloomenergy™

November 15, 2011

Office of the Secretary
Department of Natural Resources & Environmental Control
State of Delaware
89 Kings Highway
Dover, DE 19901

Subject: **Diamond State Generation Partners, LLC**
Red Lion Energy Center Project
Coastal Zone Permit Application

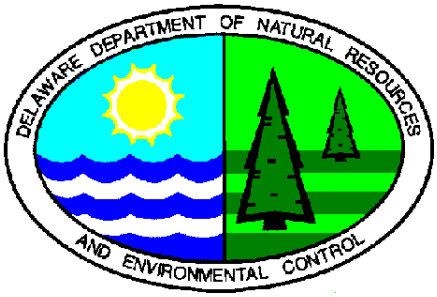
Dear Sir/Madam:

We are pleased to enclose our application for a Coastal Zone Permit for the 47 MW fuel cell powered Red Lion Energy Center. Note we have already provided the $3000 application fee to your office. We are awaiting the letter from Delaware Department of Natural Heritage Program and will forward it to you as soon as it arrives.

Should you have any questions concerning this application or if you required additional information, please contact myself or our project manager Steve Ketler at steve.ketler@bloomenergy.com or 778.565.4655.

Sincerely,

William E. Brockenborough
General Manager, Bloom Electrons
Bloomenergy



APPLICATION FOR A COASTAL ZONE ACT PERMIT

State of Delaware
Department of Natural Resources & Environmental Control
Office of the Secretary

November 11, 2011

Red Lion Fuel Cell Installation

Diamond State Generation Partners LLC
1299 Orleans Drive
Sunnyvale, California 94089

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A – Site Plan Drawing
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Permit Application Instructions

1. Complete all parts of the application. For sections which are not applicable to your project, do not leave blank; present a statement that clearly states why the section is not applicable to your project.

2. Because all applicants' projects are different, this Word document template will provide you flexibility for needed space to answer the questions. Please insert additional lines for text where needed for your application. If appropriate, attach extra pages referencing each answer by the corresponding section and question number.

3. Submit eight complete hard copies of the permit application to:

   Office of the Secretary
   Department of Natural Resources & Environmental Control
   State of Delaware
   89 Kings Highway
   Dover, DE 19901

   In addition to the eight hard copies, submit a complete electronic "pdf" copy of the permit application and a copy of the Offset Matrix in Microsoft Word format on cd-rom.

4. Comply, if required, or as requested by the DNREC Secretary, with 7 Delaware Code, Chapter 79, Section 7902. If requested, but not completed, your application will not be considered administratively complete until this form is reviewed.

5. Be sure to include your permit application fee of $3,000; otherwise the application will not be considered administratively complete. Make checks payable to the "State of Delaware."

6. Be advised that the application for a Delaware Coastal Zone Act Permit is a public document, which may be displayed at DNREC offices, public libraries, and the web, among others. If this application requires you to place confidential information or data in the application to make it administratively complete, note the Delaware Freedom of Information Act (29 Delaware Code, Chapter 100) and DNREC's Freedom of Information Act Regulation, Section 6 (Requests for Confidentiality), for the proper procedure in requesting confidentiality.

Note: This application template was last revised by DNREC on January 30, 2008. Please discard any previous versions.

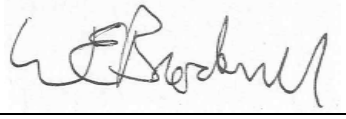
PART 1

CERTIFICATION BY APPLICANT

Under the penalty of perjury pursuant to 11 Delaware Code §1221-1235, I hereby certify that all the information contained in this Delaware Coastal Zone Act Status Decision Application and in any attachments is true and complete to the best of my belief.

I hereby acknowledge that all information in this application will be public information subject to the Delaware Freedom of Information Act, except for clearly identified proprietary information agreed to by the Secretary of the Department of Natural Resources & Environmental Control.

DIAMOND STATE GENERATION PARTNERS, LLC
Print Name of Applicant



Signature of Applicant

William E Brockenborough, Vice President
Title

November 11, 2011
Date

PART 2

APPLICANT INFORMATION AND SITE IDENTIFICATION

2.1 Identification of the applicant:

Company Name:	Diamond State Generation Partners, LLC ("Applicant")
Address:	1299 Orleans Drive, Sunnyvale, California 94089
Telephone:	(408) 543-1749
Fax:	(408) 543-1501

2.2 Primary contact: Please list the name, phone number and email of a preferred contact within your company in case the DNREC needs to contact you regarding this status decision.

Name:	William E. Brockenborough
Telephone:	Tel: (408) 543-1500
Email:	Bill.Brockenborough@bloomenergy.com

2.3 Site of proposed project (if different than above):

1593 River Road, New Castle, Delaware 19720
Tax Parcel No. 100.50.00011

2.4 Authorized agent (if any):

Name:	Shawn P. Tucker
Address:	1100 North Market Street, Suite 1000 Wilmington, Delaware 19801
Telephone:	(302) 467-4200
Fax:	(302) 467-4201
Email:	Shawn.Tucker@dbr.com

If you have an authorized agent for this status decision process, provide written authorization from client for being the authorized agent.

2.5 Is the applicant claiming confidentiality in any section of their application?

NO

If yes, see instructions on page 3.

PART 3

PROJECT SUMMARY

Provide a one-page summary describing the proposed project. Include a brief quantitative description of the anticipated environmental impacts, and how the Environmental Offset Proposal will "clearly and demonstrably" more than offset any negative impacts.

The Red Lion Fuel Cell Installation will provide up to 47 MW of electrical power that will be connected to the PJM electrical grid. The project will consist of 235 Bloomenergy ES-5700 Energy Server fuel cells that will utilize pipeline quality natural gas. The project will be built in phases, the first phase consisting of 27 MW of capacity, and the second phase an additional 20 MW.

Each fuel cell has a base load electrical output of 200 kW with a maximum natural gas usage of 1.32 MMBtu/hr (i.e., 1,282 SCFM at 1030 Btu/SCF heating value). The fuel cells will produce electricity at 480V which will be transformed to 138 kV before being sent to the nearby Delmarva Power Red Lion substation. The project will also include a water de-ionization system, natural gas pressure regulating station, an administration, a maintenance building, and an access road. The site design will incorporate the requisite stormwater and process wastewater management provisions.

Bloom's ES-5700 fuel cells utilize solid oxide fuel cell ("SOFC") technology first developed for NASA's Mars program to produce clean electrical power. The fuel cells chemically covert the natural gas to electrical power in a non-combustion process and thus generate significantly less emissions than those of competing combustion technologies and fuels (i.e., combustion turbines, reciprocating engines, boilers, coal)

The Project will remove approximately 9.3 acres of land from agricultural production and use it for clean energy production, displacing energy produced from other sources within the PJM grid that combust coal and oil. Stormwater runoff from the developed portion of the property will no longer contain agricultural residues from fertilizer and pesticides. Stormwater will be managed in accordance with State of Delaware and New Castle County regulations. Three bioretention basins and a grass filter strip will be used to treat stormwater runoff from the developed portion of the property. Sanitary wastewater will be treated onsite in a permitted wastewater disposal (septic) system. Groundwater will be treated through softening and reverse osmosis processes, and used for equipment cooling. The treatment processes will concentrate the naturally occurring dissolved solids into a fraction of the groundwater that is withdrawn. The water with the concentrated dissolved solids (estimated to be approximately 500 parts per million) will be returned to the ground as recharge.

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PART 4

PROJECT PROPERTY RECORD AND EVIDENCE OF LOCAL ZONING AND PLANNING APPROVAL

PROJECT PROPERTY RECORD

4.1 Name and address of project premises owner(s) of record:

Name: Delmarva Power & Light Company
Address: 800 King Street
Wilmington, Delaware 19801

4.2 Name and address of project premises equitable owner(s):

None

4.3 Name and address of lessee(s):

Name: Diamond State Generation Partners LLC
Address: 1299 Orleans Drive
Sunnyvale, California 94089

4.4 Is the project premises under option by permit applicant?

No.

4.5 What is the present zoning of the land for this entire project site?

Suburban

EVIDENCE OF LOCAL ZONING AND PLANNING APPROVAL

I, Kenneth R. Bieri, for New Castle County
(Name of County, City of Town)

do hereby affirm that the project proposed by Diamond State Generation Partners LLC
(Name of Applicant)

located at 1593 River Road, New Castle, DE (TPN: 10-050.00-011), in
(Address)

the S (Suburban) zoning district is in

full compliance with the zoning code as it applies to this project. The proposed use of power cells to generate electricity without combustion via a chemical reaction between natural gas and certain metals is classified as a minor utility and permitted as a limited use in this zoning district.

The above named applicant's project is in compliance with the adopted comprehensive development plan for the geographic area within which the project will be located.

Kenneth R Bieri
(Signature)

ASSISTANT PLANNING MANAGER
(Title)

9/22/11
(Date)

This part is essential for a complete Coastal Zone Act Permit Application. No application will be considered administratively complete without it. While the applicant is strongly advised to use this form, the local zoning jurisdiction may utilize a different form or document to demonstrate "evidence of local zoning approval," provided such documents are signed and dated by the proper official

PART 5

PROJECT OPERATIONS

5.1 Describe the characteristics of the manufactured product and all the process and/or assembly operations utilized by the proposed project. Include in the description (use attachments if necessary):

a. the raw materials, intermediate products, by-products and final products and characteristics of each. Review any materials' risk of carcinogenicity, toxicity, mutagenicity and/or the potential to contribute to the formation of smog. Provide material safety data sheets (MSDS) if available;

Raw materials:	natural gas, groundwater, air
By products:	water vapor, water, and air emissions (see 6.1)
Final products:	electricity to PJM grid

b. the step-by-step procedures or processes for manufacturing and/or assembling the product(s). Provide a flow diagram to illustrate procedures;

Natural gas is piped to the fuel cells 'stacks' where it is oxidized and causes electrical current to be generated. The electricity is then transformed to utility voltage and conveyed to the grid. A de-ionized cooling water system will be installed. Cooling water will only be needed when the fuel cells are not in operation. The Figure in Attachment A to this document provides a flow diagram of the overall process.

c. the nature of the materials mentioned above in 5.1(a) as to whether or not the materials require special means of storage or handling;

No special storage or handling is required.

d. list the machinery (new and/or existing) to be utilized by this project;

Fuel cells (new)
Water treatment system (new)
Natural gas pressure reducing and regulating station (new)

e. list any new buildings or other facilities to be utilized;

Administration and maintenance building

f. list the size and contents of any anticipated aboveground or underground storage tank systems that may be constructed or utilized in support of facility operations;

Two above ground storage tanks for de-ionized water

- Tank A – 30,000 gallons capacity
- Tank B – 23,000 gallons capacity

One underground tank will be installed as part of the onsite waster water disposal system (septic tank).

g. if this project represents an increase or decrease in production at an already existing facility, what will be the new rate of maximum production?

Not applicable

h. if this project represents a totally new facility at a new or existing site, what will be the maximum production rate?

47 MW of electricity, built in two phases.

- Phase One: 27 MW
- Phase Two: 20 MW

5.2 Describe daily hours of plant operations and the number of operating shifts.

24 hours per day, 7 days per week
One operating shift

5.3 Provide a site plan of this project with:

a. a north arrow;

b. a scale of not less than one inch to 200 feet;

c. identity of the person responsible for the plan, including any licenses and their numbers;

d. the acreage of the applicant's entire property and acreage of the proposed project;

e. property lines of entire property;

f. lines designating the proposed project area for which application is being made, clearly distinguished from present facilities and operating areas (if any);

g. existing and proposed roads, railroads, parking and loading areas, piers, wharfs, and other transportation facilities;

h. existing water bodies and wetlands and proposed dredge and fill areas, and;

i. existing and proposed drainage ways, gas, electric, sewer, water, roads, and other rights-of-way.

Site plan drawing in the format requested is contained in Attachment B to this document.

5.4 How many acres of land in total are required for this proposed project?

The property is 42.2 acres in size. Approximately 22.3 acres of the property currently is used for field crop commercial agricultural purposes. The proposed facility (road, parking, grass, buildings, and electricity generation will use approximately 9.3 acres of the agricultural land.

5.5 Has the property been involved with a state or federal site cleanup program such as Superfund, Brownfields, HSCA Voluntary Cleanup Program, RCRA Corrective Action, Aboveground or Underground Storage Tank Cleanup Programs? If so please specify which program.

No

5.6 With regards to environmental cleanup actions, has a Uniform Environmental Covenant, Final Plan of Remedial Action, or no further action letter been issued by the Department? If so are the planned construction activities consistent with the requirements or conditions stated in these documents?

No

PART 6A

ENVIRONMENTAL IMPACTS

Air Quality

6.1 Describe project emissions (new, as well as any increase or decrease over current emissions) by type and amount under maximum operating conditions:

The following table shows the facility's maximum emissions at full build-out of 235 fuel cells, with a rated power capacity of 47 MW. The daily maximum energy production will be 1,128 MWh at full capacity.

Pollutant	**Existing Emissions**		**Net Increase/Decrease**		**New Total Emissions**		**Percent Change (compare tons/year)**
	lbs/day	*tons/year*	*lbs/day*	*tons/year*	*lbs/day*	*tons/year*	
NO_X	0.0	0.0	2.37	0.432	2.37	0.432	NA
CO	0.0	0.0	112.8	20.58	112.8	20.58	NA
VOC	0.0	0.0	22.56	4.12	22.56	4.12	NA
SO_2	0.0	0.0	39.48	7.21	39.48	7.21	NA

6.2 Describe how the above emissions change in the event of a mechanical malfunction or human error.

In the event of a malfunction or human error the fuel cell(s) in question will be automatically or manually shut down, causing all air emissions to cease. De-ionized water will be used to cool the fuel cells during the startup process.

6.3 Describe any pollution control measures to be utilized to control emissions to the levels cited above in 6.1.

Fuel cells control emissions to extremely low levels by nature; no additional 'end of pipe' control systems will be used.

6.4 Show evidence that applicant has, or will have, the ability to maintain and utilize this equipment listed in 6.3 in a consistently proper and efficient manner. (For example, provide college transcripts and/or records of training courses and summary of experience with this pollution control equipment of person(s) responsible for pollution control equipment, and/or provide copies of contracts with pollution control firms to be responsible for maintaining and utilizing this equipment.)

Not applicable – no air emissions control systems required.

Water Quality

6.5 Describe wastewater discharge (new, as well as any increase or decrease over current discharge levels) due to project operations:

Pollutant	Current Discharge Concentration (ppm)	New or Changed Discharge Concentration (ppm)	Current Discharge		Net Increase/Decrease		New Total Emissions	
			gal/day	*gal/year*	*average gal/day*	*average gal/year*	*average gal/day*	*average gal/year*
TDS	N/A	500	0	0	1,267	462,480	1,267	462,480

6.6 Describe the current method of employee sanitary wastewater disposal and any proposed changes to that system due to this proposed project.

Current: Not Applicable
Future: On-Site Wastewater Disposal System (Septic)

6.7 Identify the number, location, and name of receiving water outfall(s) of any and all process wastewater discharge (new or current) affected by this proposed project. Provide NPDES Permit Numbers for each discharge affected.

The project will not have a process wastewater discharge to surface water. Process wastewater that results from water treatment units (water softener and reverse osmosis rsystem) will be infiltrated on site to recharge groundwater. The process wastewater is anticipated to met Safe Drinking Water Act criteria and not impact groundwater quality. A State of Delaware permit will be required (probably a Class V UIC permit). Bloom Energy will apply for the required permit and will comply with the requirements of the permit issued.

6.8 If any effluent is discharged into a public sewer system, is there any pretreatment program? If so, describe the program.

None

6.9 Stormwater:

a. Identify the number, location, and name of receiving waters of stormwater discharges. Provide permit number for each discharge. _____

Number of discharges: Three (3)

Location of outfall:	Bioretention area north of the site
Receiving water body:	Delaware River
Permit Number:	application under review by New Castle County Department of Land Use

b. Describe the sources of stormwater run-off (roofs, storage piles, parking lots, etc).

Administration building roof, vehicle parking lot, paved driveway, crushed stone covered areas and 235 ES-5700 Energy Servers within facility

c. Describe the amount of stormwater run-off increase over current levels that will result from the proposed project.

The Stormwater Management Study completed for the project is provided in Attachment C. According to the study, the project will result in a reduction in the amount (volume) of stormwater that will be generated on the property. This reduction is attributable to the use of bioretention basins.

2 yr storm event – 0.106 acre feet reduction
10 yr storm event – 0.171 acre feet decrease
100 yr storm event – 0.434 acre feet decrease

d. Describe any pollutants likely to be in the stormwater.

Stormwater quality will improve over current levels as pesticides, herbicides and fertilizers will no longer be applied to the developed land and be discharged in the stormwater as currently happens. Stormwater from the developed portion of the site will be routed through a grass filter (road and parking lot drainage) and through three bioretention basins, identified as best management practices by New Castle County and the State of Delaware, to remove sediment, oils and greases that potentially could be in the stormwater runoff from areas used by vehicles. Vehicle use on site will be low volume.

e. Describe any pollution control device(s) or management technique(s) to be used to reduce the amount of stormwater generated, and devices to improve the quality of the stormwater run-off prior to discharge.

Stormwater quality measures are designed into the project to meet New Castle County and State of Delaware requirements. These measures include:

3 bioretention areas, 2 of which will provide infiltration

1 grass filter strip for entrance road

f. Describe any new or improved stormwater drainage system required to safely carry off stormwater without flooding project site or neighboring areas down gradient.

Stormwater discharge points from the property flow directly to the Delaware River. Flooding in this reach of the Delaware River is controlled by tidal conditions. Stormwater from the developed portion of the property will be routed through bioretention basins that will reduce the volume of sotrmwater runoff that leaves the property when compared to existing conditions.

6.10 Will this project use a new water intake device, or increase the use (flow) from an existing intake device?

No.

If yes, state:

a. the volume of water to be withdrawn, and;

b. describe what will be done to prevent entrainment and/or entrapment of aquatic life by the intake device.

6.11 Will this proposed project result in a thermal discharge of water, or an increase in the flow or temperature of a current thermal discharge?

No. Cooling water will be vaporized. Stormwater from developed portions of the property will be routed through bioretention basins that will serve to cool the runoff from pavements and other heat absorbing surfaces prior to discharge.

If yes, state:

a. the volume of the new flow or increase from the existing thermal discharge, both in flow and amount of heat;

b. how warm will the water be when it is discharged into a receiving waterway, discharge canal, or ditch, and what will be the difference in discharge temperature and ambient temperature (delta T) at various seasons of the year after all cooling water mechanisms have been applied to the hot water?

c. the equipment and/or management techniques that will be used to reduce the thermal load of the discharge water.

6.12 Will any proposed new discharge or change in existing discharge cause, or have potential to cause, or contribute to, the exceedance of applicable criteria appearing in the "State of Delaware Surface Water Quality Standards"?

No.

If yes, explain: If a discharge to surface water is proposed, it will be designed to ensure that it will not cause or contribute to a condition that exceeds applicable criteria of the State of Delaware Surface Water Quality Standards. In the event that a surface water discharge is proposed, an NPDES permit will be required.

6.13 Describe any oils discharged to surface waters due to this proposed project.

None

6.14 Describe any settleable or floating solid wastes discharged to surface waters due to this project.

None

6.15 Show evidence that the applicant has, or will have, the ability to maintain and utilize any water pollution control equipment listed in questions 6.5 through 6.14 in a consistently proper and efficient manner. (For example, provide operator license numbers, college transcripts and/or training courses and summary of prior experience with this pollution control equipment of person(s) responsible for pollution control equipment, and/or provide copies of contracts with pollution control firms.)

Maintenance of the stormwater management system will be performed in accordance with New Castle County and State of Delaware standards and requirements.

6.16 Estimate the amount of water to be used for each specified purpose including cooling water. State daily and maximum water use in the unit of gallons per day for each purpose and source of water. State if water use will vary with the seasons, time of day, or other factors.

Water usage will normally be zero when facility is new and starts commercial operation (COD). As the facility ages, a fraction of the fuel cells will be under service at any given time and will require de-ionized water for a period of twelve hours as they start up. Groundwater from a new well will be treated (de-ionized) using softeners and a reverse-osmosis system. The de-ionized water will be stored in on-site tanks, for use only when units are shut down and not producing electricity. Potable water will come directly from the well (approximately 50 gallons per day). Maximum daily groundwater consumption will be approximately 8,640 gallons, occurring one or two days per year. The daily

average groundwater consumption will be approximately 3,889 gallons, and assumes that a grid event occurs that requires the entire facility to shutdown and then restart. Consumption is a function of fuel cells shut downs, and will not depend on the seasons or time of day. A water process flow diagram is provided in Attachment D to this application.

6.17 Identify the source of water needed for the proposed project, including potable water supplies.

Groundwater well.

6.18 Are wells going to be used?

Yes

If yes:

a. Identify the aquifer to be pumped and the depth, size and pumping capacity of the wells.

Aquifer name:	Potomac
Depth of well:	200 feet (expected)
Capacity of well:	100 gpm (expected)

b. Has a permit been applied for to do this?

No. A permit application for the well is being prepared.

c. How close is the proposed well(s) to any well(s) on adjacent lands?

½ mile away. The locations of known wells in the vicinity of site are shown in the figure provided in Attachment E.

Solid Waste

6.19 Will this project result in the generation of any solid waste?

Yes

If yes, describe each type and volume of any solid waste (including biowastes) generated by this project, and the means used to transport, store, and dispose of the waste(s).

Paper wastes – 3000 lbs per year.
Plastic wastes – 1000 lbs per year
Glass wastes – 500 lbs per year
Metal wastes –500 lbs per year
E-wastes – 10,000 lbs per year

All solid wastes will be collected by truck and recycled to the maximum extent practicable.

6.20 Will there be any on-site recycling, re-use, or reclamation of solid wastes generated by this project?

Yes

If yes, describe:

Paper, plastic, glass and metal waste generated in the administration/maintenance building will be separated on site and collected and recycled by local waste management companies in compliance with the Delaware Universal Recycling Law. Electronic waste ("E" waste) will be recycled and re-used onsite, recycled at one of DSWA's electronic goods recycling facilities.

6.21 Will any waste material generated by this project be destroyed on-site?

No

If yes, how will that be done?

Hazardous Waste

6.22 Will this proposed project result in the generation of any hazardous waste as defined by the "Delaware Regulations Governing Hazardous Waste"?

No

If yes, identify each hazardous waste, its amount, and how it is generated:

6.23 Describe the transport of any hazardous waste and list the permitted hazardous waste haulers that will be utilized.

Not Applicable

6.24 Will the proposed project cause the applicant to store, treat, and/or dispose of hazardous waste?

No

If yes, describe:

6.25 Does the applicant currently generate any hazardous waste at this site?

No

If yes, describe:

Habitat Protection

6.26 What is the current use of the land that is to be used for the proposed project?

Agriculture

6.27 Will the proposed project result in the loss of any wetland habitat?

No. The project avoids physical disturbance of wetlands and provides upland buffers between areas of disturbance and the neighboring wetlands. Bloom Energy understands that the wetlands adjoining the project area are considered foraging grounds that support the heronry on Pea Patch Island and other wildlife.

6.28 Will any wastewater and/or stormwater be discharged into a wetland?

Yes. Stormwater discharged from the property should have a salinity that is

similar to the water in the receiving wetlands bordering the Delaware River.

6.29 Will the proposed project result in the loss of any undisturbed natural habitat or public use of tidal waters?

No. The project does not impact public use of tidal waters and does not disturb natural habitat. Upland buffer areas have been incorporated in the project design between areas being developed and adjacent wetlands.

6.30 Do threatened or endangered species (as defined by the DNREC and/or the Federal Endangered Species Act) exist at the site of the proposed project, or immediately adjacent to it?

No. See Attachment F which contains letter from the State of Delaware Natural Heritage Program.

If yes, list each species:

6.31 Will this proposed project have any effect on these threatened or endangered species (as defined by the DNREC and/or the Federal Endangered Species Act).

No. See Attachment F which contains letter from the State of Delaware Natural Heritage Program.

If yes, explain:

6.32 What assurances can be made that no threatened or endangered species exist on the proposed project site?

The land being developed by the project is in active use for commercial agricultural field crop production. Based on a review of historical aerial photographs, the agricultural use has been in existence since at least 1937. No wetlands or woodlands are being developed. Historical aerial photographs are provided in Attachment F.

6.33 Describe any filling, dredging, or draining that may affect nearby wetlands or waterways.

None

6.34 If dredging is proposed, how much will occur and where will the dredged materials go for disposal?

No dredging is proposed.

Other Environmental Effects

6.35 Describe any noticeable effects of the proposed project site including: heat, glare, noise, vibration, radiation, electromagnetic interference, odors, and other effects.

None

6.36 Describe what will be done to minimize and monitor such effects.

Not applicable

6.37 Describe any effect this proposed project will have on public access to tidal waters.

None

6.38 Provide a thorough scenario of the proposed project's potential to pollute should a major equipment malfunction or human error occur, including a description of backup controls, backup power, and safety provisions planned for this project to minimize any such accidents.

A natural gas leak could occur in the piping system to the facility. In such an event automatic valves will shut off the flow of natural gas to the affected portion of the facility, which would be shut down and repaired.

A major transformer could fail and leak oil. In this event the oil will be contained by the concrete containment sump around the transformer until maintenance crews can remove the oil from site for processing and repair the transformer.

6.39 Describe how the air, water, solid and hazardous waste streams, emissions, or discharge change in the event of a major mechanical malfunction or human error.

No change to process wastewater discharge from the water softener and reverse osmosis system.

PART 6B

ENVIRONMENTAL OFFSET PROPOSAL REDUCTION CLAIM

Is applicant claiming the right to have a reduced offset proposal due to past voluntary improvements as defined in the "Regulations Governing Delaware's Coastal Zone"?

No

If yes, provide an attachment to the application presenting sufficient tangible documentation to support your claim.

PART 6C

ENVIRONMENTAL OFFSET PROPOSAL

If the applicant or the Department finds that an Environmental Offset Proposal is required, the proposed offset project shall include all the information needed to clearly establish:

A. A qualitative and quantitative description of how the offset project will "*clearly and demonstrably"* more than offset the negative impacts from the proposed project.

B. How and in what period of time the offset project will be carried out.

C. What the environmental benefits will be and when they will be achieved.

D. What scientific evidence there is concerning the efficacy of the offset project in producing its intended results.

E. How the success or failure of the offset project will be measured in both the short and long term.

F. What, if any, negative impacts are associated with the offset project.

G. How the offset will impact the attainment of the Department's environmental goals for the Coastal Zone and the environmental indicators used to assess long-term environmental quality within the Coastal Zone.

Additional Offset Proposal Information for the Applicant

1. The offset proposals must "*clearly and demonstrably*"[1] more than offset any new pollution from the applicant's proposed project. The applicant can claim (with documentation) evidence of past voluntary environmental investments (as defined in the Regulations) implemented prior to the time of application. Where the Department concurs with the applicant that such has occurred, the positive environmental improvement of the offset proposal against the new negative impact can be somewhat reduced.

2. The applicant must complete the Coastal Zone Environmental Impact Offset Matrix. This matrix can be found on the CZA web page (http://www.dnrec.delaware.gov/Admin/CZA/CZAHome.htm, or by clicking on this link. On page one, the applicant must list all environmental impacts in the column labeled "Describe Environmental Impacts." In the column to the immediate right, the applicant should reference the page number of the application or attachment which documents each impact listed. In the "Describe Environmental Offset Proposal" column, applicant must state what action is offsetting the impact. The offset action shall be referenced by page number in the column to the right to show how the offset will work. The applicant shall not utilize the far right column. *Please ensure the matrix is complete, detailed, and as specific as possible, given the allotted space. Also, thoroughly proof-read to ensure there are no spelling or grammatical errors.* The applicant must submit a completed matrix both in hardcopy and electronic form.

3. Please note: the entire offset proposal, including the matrix, shall be available to the public, as well as the evidence of past voluntary environmental enhancements.

The completed project offset matrix is provided in Attachment G to this document.

[1] For purposes of this requirement, the DNREC will interpret the phrase "clearly and demonstrably" to mean an offset proposal that is obviously so beneficial without detailed technical argument or debate. The positive environmental benefits must be obviously more beneficial to the environment than the new pollution that minimal technical review is required by the Department and the public to confirm such. The total project must have a positive environmental impact. The burden of proof is on the applicant.

PART 7

ECONOMIC EFFECTS

Construction

7.1 Estimate the total number of workers for project construction and the number to be hired in Delaware.

Total number or workers for construction (FTE)	50
Number to be hired in Delaware	25

7.2 Estimate the weekly construction payroll.

$150,000 (average)

7.3 Estimate the value of construction supplies and services to be purchased in Delaware.

$2,500,000

7.4 State the expected dates of construction initiation and completion.

Start:	November 15, 2011
Completion:	September 30, 2012

7.5 Estimate the economic impact from the loss of natural habitat, or any adverse economic effects from degraded water or air quality from the project on individuals who are directly or indirectly dependent on that habitat or air or water quality (e.g. commercial fishermen, waterfowl guides, trappers, fishing guides, charter or head boat operators, and bait and tackle dealers).

None

Operations

7.6 State the number of new employees to be hired as a direct result of this proposed project and how many of them will be existing Delaware residents and how many will be transferred in from other states.

New employees:	15
Delaware residents:	10
Transferees:	5

7.7 If employment attributable to the proposed project will vary on a seasonal or periodic basis, explain the variation and estimate the number of employees involved.

No seasonal variation

7.8 Estimate the percent distribution of annual wages and salaries (based on regular working hours) for employees attributable to this project:

Wage/salary	Percent of employees
<$10,000	
$10,000-14,999	
$15,000-24,999	
$25,000-34,999	
$35,000-49,999	
$50,000-64,999	10
$65,000-74,999	25
$75,000-99,999	40
>$100,000	25

7.9 Estimate the annual taxes to be paid in Delaware attributable to this proposed project:

State personal income taxes:	$132,236
State corporate income taxes	8.7% per year after permitted deductions
County and school district taxes:	$273,000
Municipal taxes:	$100,100 before any economic development reduction

PART 8

SUPPORTING FACILITIES REQUIREMENTS

Describe the number and type of new supporting facilities and services that will be required as a result of the proposed project, including, but not limited to:

a. Roads

None

b. Bridges

None

c. Piers and/or docks

None

d. Railroads

None

e. Microwave towers

None

f. Special fire protection services not now available

None

g. Traffic signals

None

h. Sewer expansion

None

i. Energy related facilities expansion

None

j. Pipelines

None

PART 9

AESTHETIC EFFECTS

9.1 Describe whether the proposed project will be located on a site readily visible from a public road, residential area, public park, or other public meeting place (such as schools or cultural centers).

Project will be visible from a public road.

9.2 Is the project site location within a half mile of a place of historic or scenic value?

No

9.3 Describe any planned attempt to make the proposed facility aesthetically compatible with its neighboring land uses. Include schematic plans and/or drawings of the proposed project after it is complete, including any landscaping and screening.

The Landscaping Plan drawing for the project is provided in Attachment H to this document.

PART 10

EFFECTS ON NEIGHBORING LAND USES

10.1 How close is the nearest year-round residence to the site of this proposed project?

0.5 miles

10.2 Will this proposed project interfere with the public's use of existing public or private recreational facilities or resources?

No

10.3 Will the proposed project utilize or interfere with agricultural areas?

Will reduce land available for agriculture.

10.4 Is there any possibility that the proposed project could interfere with a nearby existing business, commercial or manufacturing use?

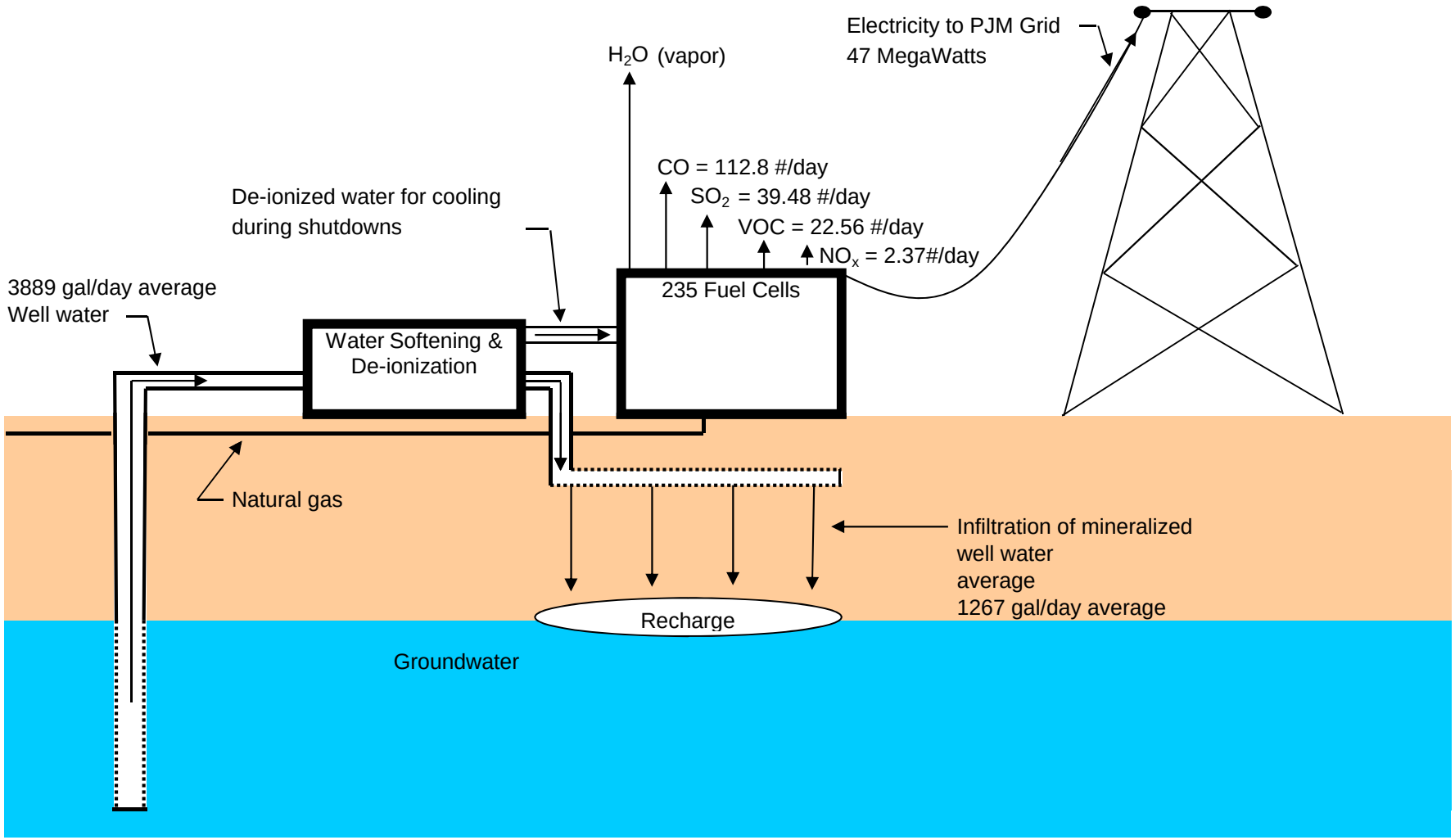
No

END OF APPLICATION

ATTACHMENTS TO FOLLOW

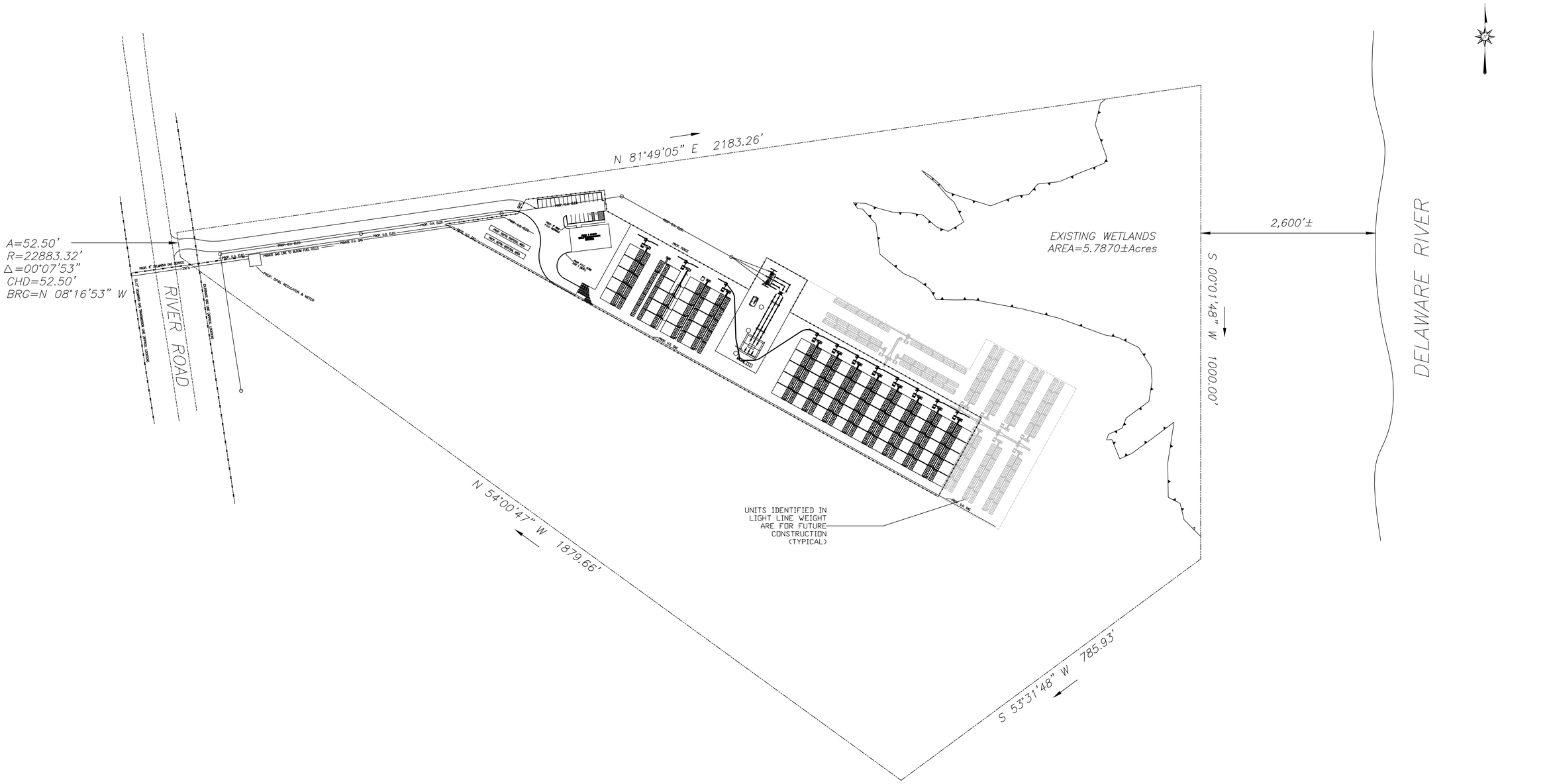
ATTACHMENT A

OVERALL FACILITY PROCESS DIAGRAM


Electricity to PJM Grid
47 MegaWatts
H_2O (vapor)
CO = 112.8 #/day
SO_2 = 39.48 #/day
VOC = 22.56 #/day
NO_x = 2.37#/day
De-ionized water for cooling
during shutdowns
3889 gal/day average
Well water
235 Fuel Cells
Water Softening &
De-ionization
Natural gas
Infiltration of mineralized
well water
average
1267 gal/day average
Recharge
Groundwater

ATTACHMENT B

SITE PLAN DRAWING



PLAN DATA

1. TAX PARCEL NUMBER: 10-050.00-011
2. SOURCE OF TITLE: D.R. K-101-27
3. GROSS AREA: 42.20 ACRES
4. AREA TO BE DEVELOPED: 11.20 ACRES

PLAN TO ACCOMPANY
COASTAL ZONE PERMIT
PREPARED FOR
RED LION ENERGY CENTER
LOCATED AT
1593 RIVER ROAD
NEW CASTLE HUNDRED, NEW CASTLE COUNTY, DELAWARE

M&Z
McBRIDE & ZIEGLER, INC.
LAND SURVEYORS • PLANNERS • ENGINEERS
2607 EASTBURN CENTER, NEWARK, DELAWARE 19711
PHONE (302) 737-9138 • FAX (302) 737-2610

APPROVED BY: _____
MARK ZIEGLER, P.E. (DE #7502)

SURVEY BY: M&Z	**CHECKED BY:** M.Z.
DESIGN BY: DE	**SCALE :** 1" = 100'
DRAWN BY: DE	**DATE :** OCTOBER 3, 2011
DWG. NO. : 20114559	SHEET 1 of 1

ATTACHMENT C

STORMWATER MANAGEMENT STUDY

STORMWATER MANAGEMENT STUDY

PREPARED FOR

DIAMOND STATE GENERATION PARTNERS, LLC

LOCATED AT

1593 RIVER ROAD

SITUATE IN

NEW CASTLE HUNDRED, NEW CASTLE COUNTY, DELAWARE

JULY 2011

Revised;

September, 2011
October, 2011

TABLE OF CONTENTS

NARRATIVE

This Stormwater Management Study was prepared for commercial land development of Diamond State Generation Partners, LLC a.k.a. Red Lion Energy Center. It contains all necessary information to show compliance with the Delaware Sediment and Stormwater Regulations and the New Castle County Drainage and Unified Development Codes required for Construction Plan approval.

EXISTING CONDITIONS:

Diamond State Generation Partners, LLC is located at 1593 River Road (Route 9) on the northbound side, south of the intersection of Hamburg Road. The site is currently being leased by DP&L as a crop field to a local farmer who is currently harvesting wheat. The remaining portions of the site consist of areas of young and mature forest and wetlands from the Delaware River.

SOILS:

In accordance with the USDA -NRCS Web Soil Survey for New Castle County, the following soils have been identified on this site;

Br—Broadkill mucky peat, very frequently flooded, tidal

The Broadkill, very frequently flooded, tidal component makes up 70 percent of the map unit. Slopes are 0 to 1 percent. This component is on coastal plains, tidal marshes. The parent material consists of loamy marine sediments, high in silt.

ReB—Reybold silt loam, 2 to 5 percent slopes

The Reybold component makes up 75 percent of the map unit. Slopes are 2 to 5 percent. This component is on interfluves. The parent material consists of high silt loamy eolian deposits over fluviomarine deposits.

ReC—Reybold silt loam, 5 to 10 percent slopes

The Reybold component makes up 75 percent of the map unit. Slopes are 5 to 10 percent. This component is on interfluves. The parent material consists of high silt loamy eolian deposits over fluviomarine deposits.

SuA—Sunken mucky silt loam, 0 to 2 percent slopes, occasionally flooded, tidal

The Sunken component makes up 80 percent of the map unit. Slopes are 0 to 2 percent. This component is on submerged upland tidal marshes, lowlands, flats. The parent material consists of silty eolian deposits over fluviomarine sediments.

FLOODPLAIN:
This site lies partially within a FEMA floodplain in accordance with FEMA Map No.10003C0235J and 255J dated January 17, 2007. According to the FEMA map, the 100 year floodplain elevation has been determined to be elev. 9. However, based on the topographic survey, elev. 9 is located off of the property and therefore the site is not located within the FEMA floodplain. The area of disturbance for the proposed substation is well outside of the mapped FEMA floodplain limit and its related riparian buffer. As such, the FEMA floodplain has no impact on this development and a letter of Map Revision or Map Amendment from FEMA is not required.

WETLANDS:
A wetlands investigation was performed by Atlantic Hydrologic Inc. in June, 2011. Wetlands were found to exist.

WRPA:
There are no water Resource Protection Areas located on this site per WRPA map 2 of 3 dated, February 2006.

PROPOSED CONDITIONS:
This site is being partially developed as an electrical substation on lands owned by DP&L Company in an "S" zoning district. The electrical substation is considered to be a "Minor Utility" and is proposed to be constructed in 2 phases. The first phase consists of the proposed entrance drive, parking area, storage / maintenance building and a small electrical substation yard. The second phase will consist of a building expansion and expansion of the electrical substation yard. The proposed grading, stormwater management analysis and overall design includes the future expansion and development within this submission. This gives the owner/operator the most flexibility for planning the expansion and minimizes earth moving and disturbing activities.

STORMWATER MANAGEMENT:
The site is located adjacent the Delaware River. A waiver for Stormwater Quantity control is being requested per section 3.2.2.2 of the Delaware Sediment and Stormwater Regulations.

There are 4 analysis points for this project (1X through 4X). Analysis point 1X represents the Delaware River. All areas of this site contribute to 1X. Analysis point 2X is located to the south east and represents the location that this site contributes runoff to the adjoining DP&L property. Analysis point 3X also contributes runoff to the adjoining DP&L property and is located to the south. Analysis point 4X is located to the southwest and contributes runoff to the adjoining Getty Refinement property to the north. 4X eventually drains back onto the project site and then drains directly into the Delaware River. A diversion swale and storm sewer pipe is proposed to keep most onsite and offsite runoff away from the substation yard (refer to the Offsite Areas section).

The analysis points have been joined together without the use and/or definition of any reaches. Reaches were eliminated to simplify the calculations and to produce a more conservative estimate of post development peak flow rates. When defined, reaches reduce or attenuate peak flows. Therefore, the post developed peak rates from this development to analysis point 1X are inflated and worst case scenario conditions.

QUANTITY CONTROL:
A waiver for Stormwater Quantity Control is being requested per section 3.2.2.2 of the Delaware Sediment and Stormwater Regulations; "Provisions will be made or exist for a nonerosive conveyance system to tidewater by either a closed drainage system or by open channel flow that has adequate capacity to contain the runoff events being considered as a requirement of these regulations" (refer to the Outfall Data section for adequate capacity and non-erosive conditions).

QUALITY CONTROL:
This site incorporates the "Green Technology" approach to stormwater management as best as possible. 3 Bioretention facilities and 1 grass filter strip are proposed for water quality treatment of stormwater runoff. The 3 Bioretention facilities shall provide treatment for the proposed gravel substation yard and the filter strip will provide treatment for the proposed entrance drive.

SOIL TESTING:
Soil tests were performed by Atlantic Hydrologic, Inc. in June 2011. Refer to their report for infiltration rates and ground water elevations.

OFFSITE AREAS:
There are 4 offsite drainage areas that contribute runoff through the project site. 2 of these areas identified as O1 and O2 are located to north on the adjacent Getty Refinement property. They contribute a combined total area of approx. 29.2 acres. These areas have no impact on the overall pre and post development calculations and have not been included in that analysis. A bypass swale has been designed to divert the runoff from portions of the site and offsite area O1 away from the substation yard (refer to the Swale Calculations included in this report). Area O2 discharges into the forest area below the bypass swale and has no direct impact on the development. The remaining offsite areas are located to the south and southwest and contribute runoff from River Road and the adjoining DP&L property. Significantly smaller, these areas contribute a combined total area of approx. 1.77 acres. These areas were included in the pre and post development analysis because they do have more of an impact on the overall development. These areas will be diverted away from the entrance drive and substation yard through a proposed storm sewer pipe that runs along the southside of the substation yard. The storm sewer pipe will also divert the remaining onsite areas away from the substation yard to minimize the impacts to the substation yard and proposed bioretention areas (refer to the Storm Sewer calculations included in this report).

DOWNSTREAM IMPACTS:

Negative impacts to downstream properties, channels or streams will not be created by this development for the following reasons;

1) This project is located adjacent the Delaware River. All post development runoff from the proposed substation will discharge directly into it.
2) Post-developed runoff is reduced at analysis point 2X and is unchanged at analysis points 3X and 4X discharge locations.
3) The discharge velocity from stormwater management areas to analysis point 1X is less than 2 ft. / sec. during the 2 and 10 year storms.
4) The shear stress analysis has determined that the locations for discharges from proposed swales, storm sewers and stormwater management facilities are stable and have adequate capacity in accordance with the Delaware Erosion and Sediment Control Handbook and New Castle County Drainage Code.

DRAINAGE EASEMENTS:

Drainage easements shall be provided in accordance with the New Castle County Drainage Code. Offsite easements are not required because of the sites proximity to the Delaware River.

STORM SEWERS:

Storm sewers shall be designed in accordance with DelDOT and New Castle County Standards and Regulations. Refer to the Storm Sewer section within this report.

MAINTENANCE:

Maintenance of on-site stormwater management facilities shall be performed by the leaser in accordance with DNREC and New Castle County standards and requirements.

EROSION AND SEDIMENT CONTROL

Erosion and sediment control shall be provided in accordance with the Delaware Sediment and Stormwater Regulations and the DNREC Erosion and Sediment Control Handbook.
This project will be bulk graded in one single phase and will include the grading and stormwater management features anticipated for the future expansion and development of the substation yard. A combination of silt fence and super silt fence will be utilized during construction.

METHODOLOGY:
The SCS-TR20 method contained within the computer program "HydroCad" Version 8.0 was used to generate flows, route hydrographs, calculate Time of Concentration and average CN values for both Pre and Post-developed site conditions.

Unless otherwise noted all Drainage areas, Tc paths and Cn values are based on a topographic Aerial survey performed by Axis Geospatial, LLC, in May 2011 and by the Lines and Grades Plan prepared by McBride & Ziegler in June 2011 or as later amended.

Bioretention Areas: are sized in accordance with DNREC guidelines utilizing the SCS-TR20 method in Hydrocad.

Filter Strips: are sized in accordance with DURMM.

Shear Stress Calculations: were performed using the computer program HYCHL – Version 6.1 for the Federal Highway Administration. HYCHL assists in designing stable roadside channel and irregular channel riprap linings. The channel lining stability analysis uses permissible shear stress. The bases for program algorithms are the Federal Highway Administration (FHWA) publications Hydraulic Engineering Circular 15 (HEC-15) and HEC-11. When provided design flow and channel conditions (i.e., slope, shape, and lining type), HYCHL can analyze drainage channels for stability. HYCHL can analyze all linings with a known permissible shear for both stability and maximum discharge. The output generated by HYCHL includes flow depth, velocity, calculated shear stress, permissible shear stress, and maximum discharge.

Swale Calculations: have been performed using the SCS-TR20 method contained within the computer program "HydroCad" Version 8.0. The swale was defined as a reach.

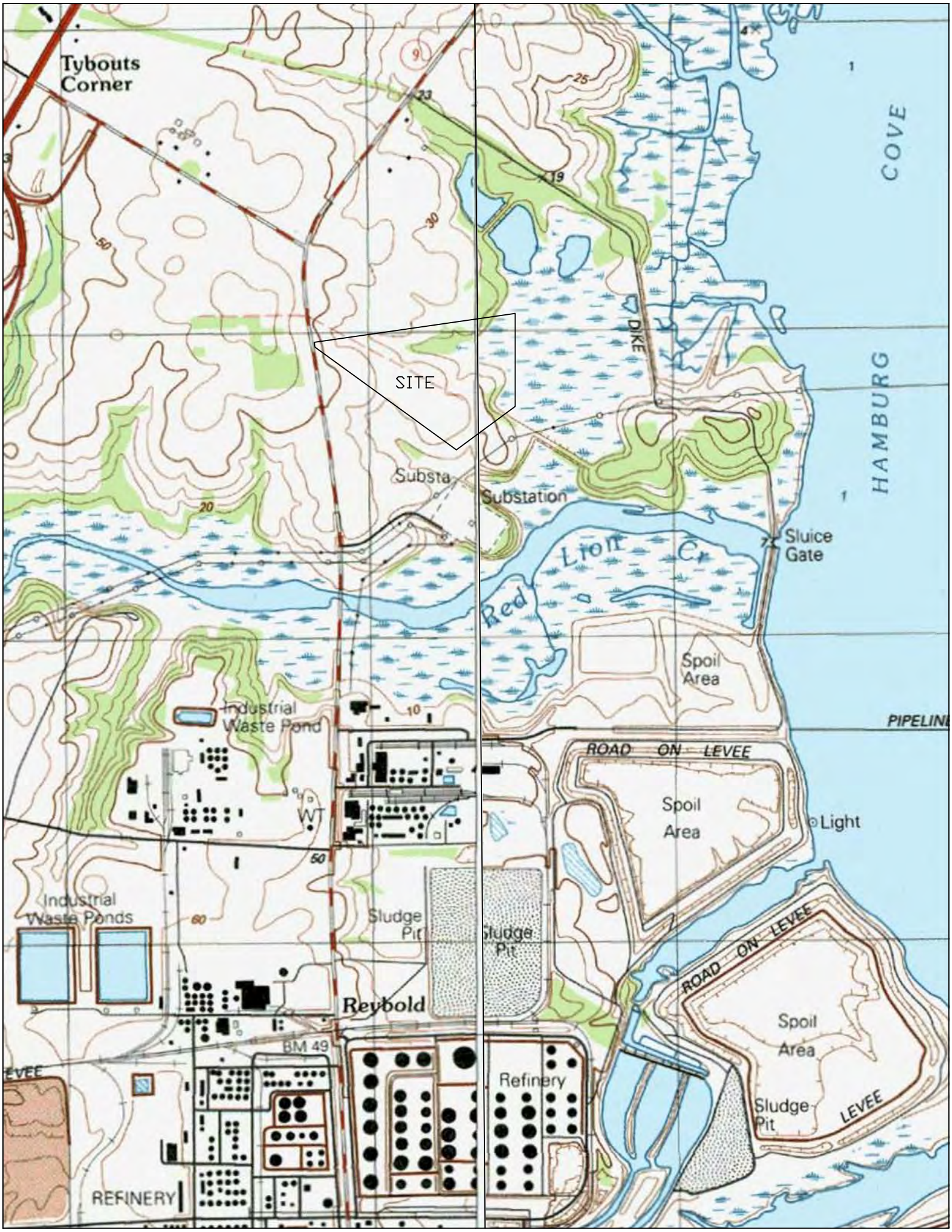
Storm Sewers: are designed in accordance with the New Castle County Drainage Code and DelDOT standards and specifications. Hydrologic analysis and pipe sizing calculations were conducted using the Rational Method presented in the computer program "HydraFlow Storm Sewers Extension for AutoCAD, Civil 3D, 2009".

PEAK FLOW (c.f.s.) SUMMARY TABLE

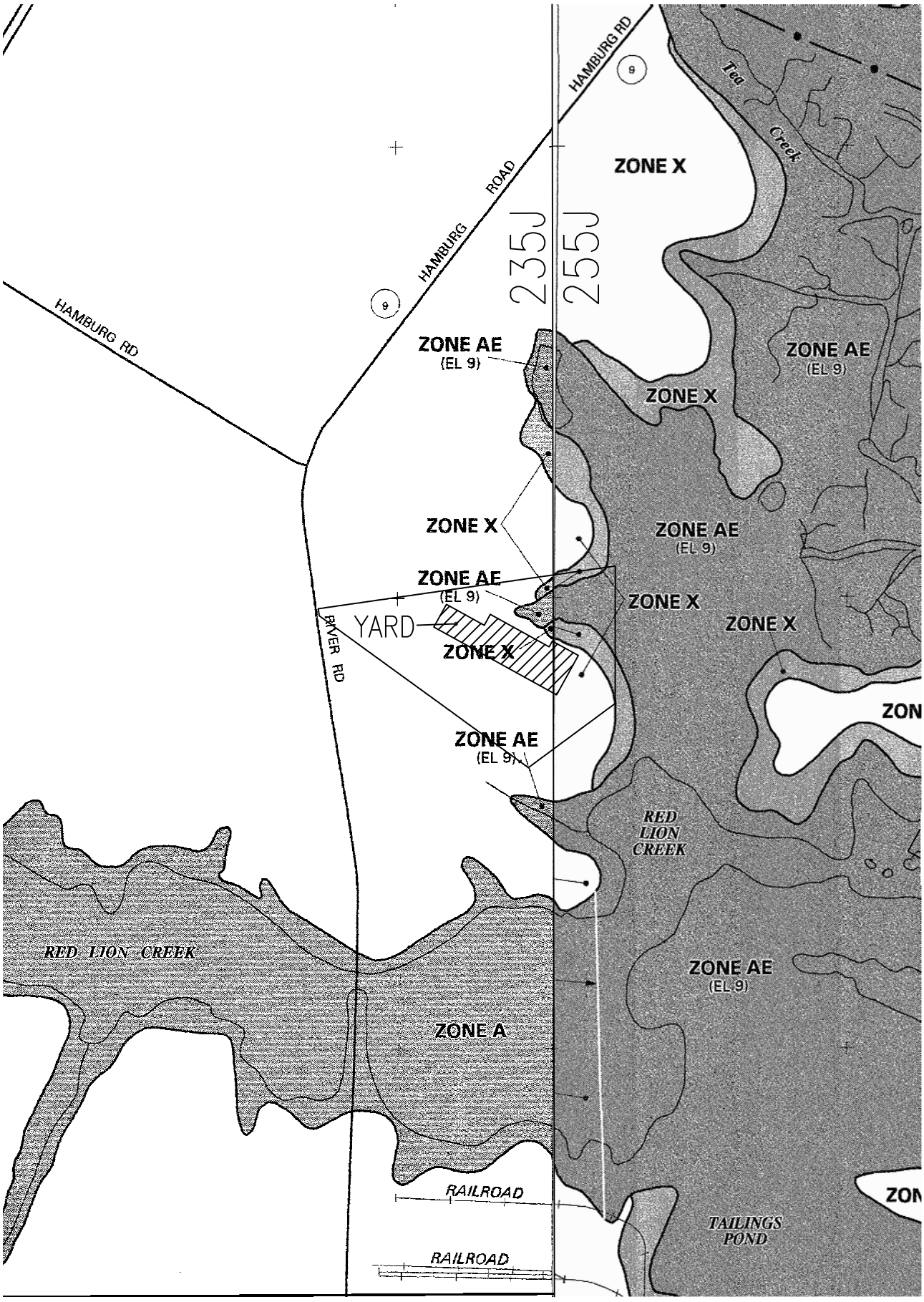
	POINT 1X		POINT 2X		POINT 3X		POINT 4X	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
2-Y	19.87	42.91	12.00	12.00	8.60	8.60	4.71	1.11
10-Y	54.03	89.58	29.30	29.30	19.69	19.69	10.16	2.18
100-Y	137.61	201.80	69.99	69.99	45.04	45.04	22.26	4.50

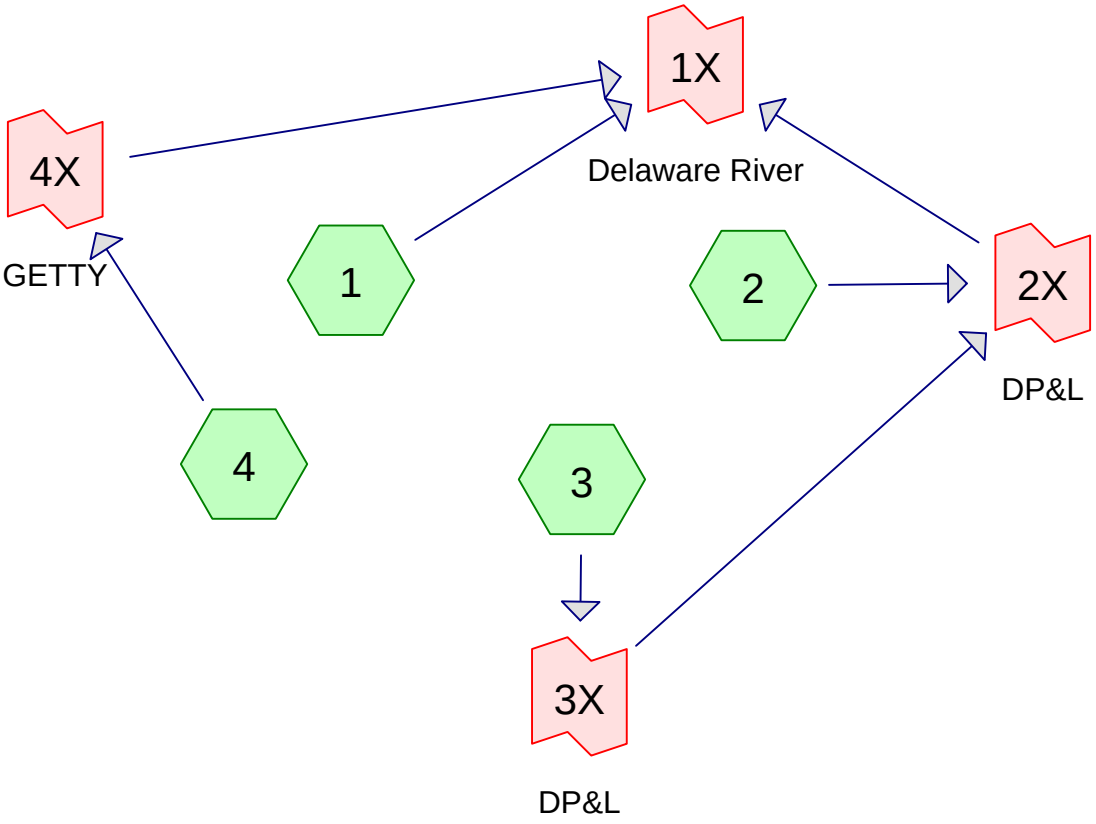
PEAK VOLUME (ac. ft.) SUMMARY TABLE

	POINT 1X		POINT 2X		POINT 3X		POINT 4X	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
2-Y	2.486	2.534	0.670	0.670	0.460	0.460	0.202	0.048
10-Y	5.934	6.102	1.565	1.565	1.030	1.030	0.437	0.098
100-Y	14.529	14.873	3.772	3.772	2.401	2.401	0.988	0.210


Tybouts Corner
SITE
DIKE
COVE
HAMBURG
Substa
Substation
Red Lion Cr
Sluice Gate
Spoil Area
Industrial Waste Pond
WT
PIPELINE
ROAD ON LEVEE
Spoil Area
Light
Industrial Waste Ponds
Sludge Pit
Sludge Pit
Reybold
BM 49
Refinery
ROAD ON LEVEE
Spoil Area
Sludge Pit
LEVEE
REFINERY


River Rd
ReC
Br
RaB
SuA
ReC


HAMBURG RD
9
HAMBURG ROAD
HAMBURG RD
9
235J
255J
Tea Creek
ZONE X
ZONE AE
(EL 9)
ZONE X
ZONE AE
(EL 9)
ZONE X
ZONE AE
(EL 9)
ZONE AE
(EL 9)
YARD
ZONE X
ZONE X
ZONE X
RIVER RD
ZONE AE
(EL 9)
RED LION CREEK
RED LION CREEK
ZONE AE
(EL 9)
ZONE A
RAILROAD
RAILROAD
TAILINGS POND



Subcat Reach Pond Link

Drainage Diagram for DSGP 1593 River Rd-PRE
Prepared by McBride & Ziegler, Inc. 10/25/2011

Subcatchment 1:

Runoff = 15.14 cfs @ 12.32 hrs, Volume= 1.614 af, Depth> 0.64"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2yr Rainfall=3.20"

Area (ac)	CN	Description
13.410	72	Small grain, SR + CR, Good, HSG B
5.830	77	Woods, Good, HSG D
0.800	84	Small grain, SR + CR, Good, HSG D
9.560	55	Woods, Good, HSG B
0.680	72	Offsite Small Grain B
30.280	68	Weighted Average
30.280		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	100	0.0200	0.35		**Sheet Flow, 1-A** Cultivated: Residue<=20% n= 0.060 P2= 3.20"
3.4	245	0.0180	1.21		**Shallow Concentrated Flow, 1-B** Cultivated Straight Rows Kv= 9.0 fps
3.5	375	0.0400	1.80		**Shallow Concentrated Flow, 1-C** Cultivated Straight Rows Kv= 9.0 fps
8.0	360	0.0070	0.75		**Shallow Concentrated Flow, 1-D** Cultivated Straight Rows Kv= 9.0 fps
3.3	775	0.0150	3.94	39.38	**Parabolic Channel, 1-E** W=15.00' D=1.00' Area=10.0 sf Perim=15.2' n= 0.035 Earth, dense weeds
9.5	470	0.0030	0.82		**Shallow Concentrated Flow, 1-F** Grassed Waterway Kv= 15.0 fps
32.4	2,325	Total			

Subcatchment 2:

Runoff = 3.46 cfs @ 12.06 hrs, Volume= 0.210 af, Depth> 0.56"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2yr Rainfall=3.20"

Area (ac)	CN	Description
1.860	58	Woods/grass comb., Good, HSG B
2.610	72	Small grain, SR + CR, Good, HSG B
4.470	66	Weighted Average
4.470		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	80	0.0300	0.40		**Sheet Flow, 2-A** Cultivated: Residue<=20% n= 0.060 P2= 3.20"
5.9	230	0.0170	0.65		**Shallow Concentrated Flow, 2-B** Woodland Kv= 5.0 fps
3.2	205	0.0450	1.06		**Shallow Concentrated Flow, 2-C** Woodland Kv= 5.0 fps
12.4	515	Total			

Subcatchment 3:

Runoff = 8.60 cfs @ 12.04 hrs, Volume= 0.460 af, Depth> 0.83"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2yr Rainfall=3.20"

Area (ac)	CN	Description
6.630	72	Small grain, SR + CR, Good, HSG B
6.630		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	100	0.0100	0.27		**Sheet Flow, 3-A** Cultivated: Residue<=20% n= 0.060 P2= 3.20"
0.9	60	0.0160	1.14		**Shallow Concentrated Flow, 3-B** Cultivated Straight Rows Kv= 9.0 fps
4.1	315	0.0200	1.27		**Shallow Concentrated Flow, 3-C** Cultivated Straight Rows Kv= 9.0 fps
11.2	475	Total			

Subcatchment 4:

Runoff = 4.71 cfs @ 11.97 hrs, Volume= 0.202 af, Depth> 0.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2yr Rainfall=3.20"

Area (ac)	CN	Description
1.500	72	Small grain, SR + CR, Good, HSG B
0.910	72	Offsite Small Grain
0.180	98	Offsite Road
2.590	74	Weighted Average
2.410		Pervious Area
0.180		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	80	0.0300	0.40		**Sheet Flow, 4-A** Cultivated: Residue<=20% n= 0.060 P2= 3.20"
1.6	150	0.0300	1.56		**Shallow Concentrated Flow, 4-B** Cultivated Straight Rows Kv= 9.0 fps
0.4	180	0.0250	7.12	71.17	**Parabolic Channel, 4-C** W=15.00' D=1.00' Area=10.0 sf Perim=15.2' n= 0.025
5.3	410	Total			

Link 1X: Delaware River

Inflow Area = 43.970 ac, Inflow Depth > 0.68" for 2yr event
Inflow = 19.87 cfs @ 12.07 hrs, Volume= 2.486 af
Primary = 19.87 cfs @ 12.07 hrs, Volume= 2.486 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 2X: DP&L

Inflow Area = 11.100 ac, Inflow Depth > 0.72" for 2yr event
Inflow = 12.00 cfs @ 12.05 hrs, Volume= 0.670 af
Primary = 12.00 cfs @ 12.05 hrs, Volume= 0.670 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 3X: DP&L

Inflow Area = 6.630 ac, Inflow Depth > 0.83" for 2yr event
Inflow = 8.60 cfs @ 12.04 hrs, Volume= 0.460 af
Primary = 8.60 cfs @ 12.04 hrs, Volume= 0.460 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 4X: GETTY

Inflow Area = 2.590 ac, Inflow Depth > 0.94" for 2yr event
Inflow = 4.71 cfs @ 11.97 hrs, Volume= 0.202 af
Primary = 4.71 cfs @ 11.97 hrs, Volume= 0.202 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Subcatchment 1:

Runoff = 41.14 cfs @ 12.29 hrs, Volume= 3.932 af, Depth> 1.56"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10yr Rainfall=4.80"

Area (ac)	CN	Description
13.410	72	Small grain, SR + CR, Good, HSG B
5.830	77	Woods, Good, HSG D
0.800	84	Small grain, SR + CR, Good, HSG D
9.560	55	Woods, Good, HSG B
0.680	72	Offsite Small Grain B
30.280	68	Weighted Average
30.280		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	100	0.0200	0.35		**Sheet Flow, 1-A** Cultivated: Residue<=20% n= 0.060 P2= 3.20"
3.4	245	0.0180	1.21		**Shallow Concentrated Flow, 1-B** Cultivated Straight Rows Kv= 9.0 fps
3.5	375	0.0400	1.80		**Shallow Concentrated Flow, 1-C** Cultivated Straight Rows Kv= 9.0 fps
8.0	360	0.0070	0.75		**Shallow Concentrated Flow, 1-D** Cultivated Straight Rows Kv= 9.0 fps
3.3	775	0.0150	3.94	39.38	**Parabolic Channel, 1-E** W=15.00' D=1.00' Area=10.0 sf Perim=15.2' n= 0.035 Earth, dense weeds
9.5	470	0.0030	0.82		**Shallow Concentrated Flow, 1-F** Grassed Waterway Kv= 15.0 fps
32.4	2,325	Total			

Subcatchment 2:

Runoff = 9.70 cfs @ 12.05 hrs, Volume= 0.534 af, Depth> 1.43"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10yr Rainfall=4.80"

Area (ac)	CN	Description
1.860	58	Woods/grass comb., Good, HSG B
2.610	72	Small grain, SR + CR, Good, HSG B
4.470	66	Weighted Average
4.470		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	80	0.0300	0.40		**Sheet Flow, 2-A** Cultivated: Residue<=20% n= 0.060 P2= 3.20"
5.9	230	0.0170	0.65		**Shallow Concentrated Flow, 2-B** Woodland Kv= 5.0 fps
3.2	205	0.0450	1.06		**Shallow Concentrated Flow, 2-C** Woodland Kv= 5.0 fps
12.4	515	Total			

Subcatchment 3:

Runoff = 19.69 cfs @ 12.03 hrs, Volume= 1.030 af, Depth> 1.86"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10yr Rainfall=4.80"

Area (ac)	CN	Description
6.630	72	Small grain, SR + CR, Good, HSG B
6.630		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	100	0.0100	0.27		**Sheet Flow, 3-A** Cultivated: Residue<=20% n= 0.060 P2= 3.20"
0.9	60	0.0160	1.14		**Shallow Concentrated Flow, 3-B** Cultivated Straight Rows Kv= 9.0 fps
4.1	315	0.0200	1.27		**Shallow Concentrated Flow, 3-C** Cultivated Straight Rows Kv= 9.0 fps
11.2	475	Total			

Subcatchment 4:

Runoff = 10.16 cfs @ 11.96 hrs, Volume= 0.437 af, Depth> 2.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10yr Rainfall=4.80"

Area (ac)	CN	Description
1.500	72	Small grain, SR + CR, Good, HSG B
0.910	72	Offsite Small Grain
0.180	98	Offsite Road
2.590	74	Weighted Average
2.410		Pervious Area
0.180		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	80	0.0300	0.40		**Sheet Flow, 4-A** Cultivated: Residue<=20% n= 0.060 P2= 3.20"
1.6	150	0.0300	1.56		**Shallow Concentrated Flow, 4-B** Cultivated Straight Rows Kv= 9.0 fps
0.4	180	0.0250	7.12	71.17	**Parabolic Channel, 4-C** W=15.00' D=1.00' Area=10.0 sf Perim=15.2' n= 0.025
5.3	410	Total			

Link 1X: Delaware River

Inflow Area = 43.970 ac, Inflow Depth > 1.62" for 10yr event
Inflow = 54.03 cfs @ 12.07 hrs, Volume= 5.934 af
Primary = 54.03 cfs @ 12.07 hrs, Volume= 5.934 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 2X: DP&L

Inflow Area = 11.100 ac, Inflow Depth > 1.69" for 10yr event
Inflow = 29.30 cfs @ 12.04 hrs, Volume= 1.565 af
Primary = 29.30 cfs @ 12.04 hrs, Volume= 1.565 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 3X: DP&L

Inflow Area = 6.630 ac, Inflow Depth > 1.86" for 10yr event
Inflow = 19.69 cfs @ 12.03 hrs, Volume= 1.030 af
Primary = 19.69 cfs @ 12.03 hrs, Volume= 1.030 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 4X: GETTY

Inflow Area = 2.590 ac, Inflow Depth > 2.02" for 10yr event
Inflow = 10.16 cfs @ 11.96 hrs, Volume= 0.437 af
Primary = 10.16 cfs @ 11.96 hrs, Volume= 0.437 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Subcatchment 1:

Runoff = 105.02 cfs @ 12.28 hrs, Volume= 9.769 af, Depth> 3.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 yr Rainfall=8.00"

Area (ac)	CN	Description
13.410	72	Small grain, SR + CR, Good, HSG B
5.830	77	Woods, Good, HSG D
0.800	84	Small grain, SR + CR, Good, HSG D
9.560	55	Woods, Good, HSG B
0.680	72	Offsite Small Grain B
30.280	68	Weighted Average
30.280		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	100	0.0200	0.35		**Sheet Flow, 1-A** Cultivated: Residue<=20% n= 0.060 P2= 3.20"
3.4	245	0.0180	1.21		**Shallow Concentrated Flow, 1-B** Cultivated Straight Rows Kv= 9.0 fps
3.5	375	0.0400	1.80		**Shallow Concentrated Flow, 1-C** Cultivated Straight Rows Kv= 9.0 fps
8.0	360	0.0070	0.75		**Shallow Concentrated Flow, 1-D** Cultivated Straight Rows Kv= 9.0 fps
3.3	775	0.0150	3.94	39.38	**Parabolic Channel, 1-E** W=15.00' D=1.00' Area=10.0 sf Perim=15.2' n= 0.035 Earth, dense weeds
9.5	470	0.0030	0.82		**Shallow Concentrated Flow, 1-F** Grassed Waterway Kv= 15.0 fps
32.4	2,325	Total			

Subcatchment 2:

Runoff = 25.11 cfs @ 12.04 hrs, Volume= 1.371 af, Depth> 3.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 yr Rainfall=8.00"

Area (ac)	CN	Description
1.860	58	Woods/grass comb., Good, HSG B
2.610	72	Small grain, SR + CR, Good, HSG B
4.470	66	Weighted Average
4.470		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	80	0.0300	0.40		**Sheet Flow, 2-A** Cultivated: Residue<=20% n= 0.060 P2= 3.20"
5.9	230	0.0170	0.65		**Shallow Concentrated Flow, 2-B** Woodland Kv= 5.0 fps
3.2	205	0.0450	1.06		**Shallow Concentrated Flow, 2-C** Woodland Kv= 5.0 fps
12.4	515	Total			

Subcatchment 3:

Runoff = 45.04 cfs @ 12.03 hrs, Volume= 2.401 af, Depth> 4.35"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 yr Rainfall=8.00"

Area (ac)	CN	Description
6.630	72	Small grain, SR + CR, Good, HSG B
6.630		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	100	0.0100	0.27		**Sheet Flow, 3-A** Cultivated: Residue<=20% n= 0.060 P2= 3.20"
0.9	60	0.0160	1.14		**Shallow Concentrated Flow, 3-B** Cultivated Straight Rows Kv= 9.0 fps
4.1	315	0.0200	1.27		**Shallow Concentrated Flow, 3-C** Cultivated Straight Rows Kv= 9.0 fps
11.2	475	Total			

Subcatchment 4:

Runoff = 22.26 cfs @ 11.96 hrs, Volume= 0.988 af, Depth> 4.58"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 yr Rainfall=8.00"

Area (ac)	CN	Description
1.500	72	Small grain, SR + CR, Good, HSG B
0.910	72	Offsite Small Grain
0.180	98	Offsite Road
2.590	74	Weighted Average
2.410		Pervious Area
0.180		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	80	0.0300	0.40		**Sheet Flow, 4-A** Cultivated: Residue<=20% n= 0.060 P2= 3.20"
1.6	150	0.0300	1.56		**Shallow Concentrated Flow, 4-B** Cultivated Straight Rows Kv= 9.0 fps
0.4	180	0.0250	7.12	71.17	**Parabolic Channel, 4-C** W=15.00' D=1.00' Area=10.0 sf Perim=15.2' n= 0.025
5.3	410	Total			

Link 1X: Delaware River

Inflow Area = 43.970 ac, Inflow Depth > 3.97" for 100 yr event
Inflow = 137.61 cfs @ 12.07 hrs, Volume= 14.529 af
Primary = 137.61 cfs @ 12.07 hrs, Volume= 14.529 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 2X: DP&L

Inflow Area = 11.100 ac, Inflow Depth > 4.08" for 100 yr event
Inflow = 69.99 cfs @ 12.03 hrs, Volume= 3.772 af
Primary = 69.99 cfs @ 12.03 hrs, Volume= 3.772 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 3X: DP&L

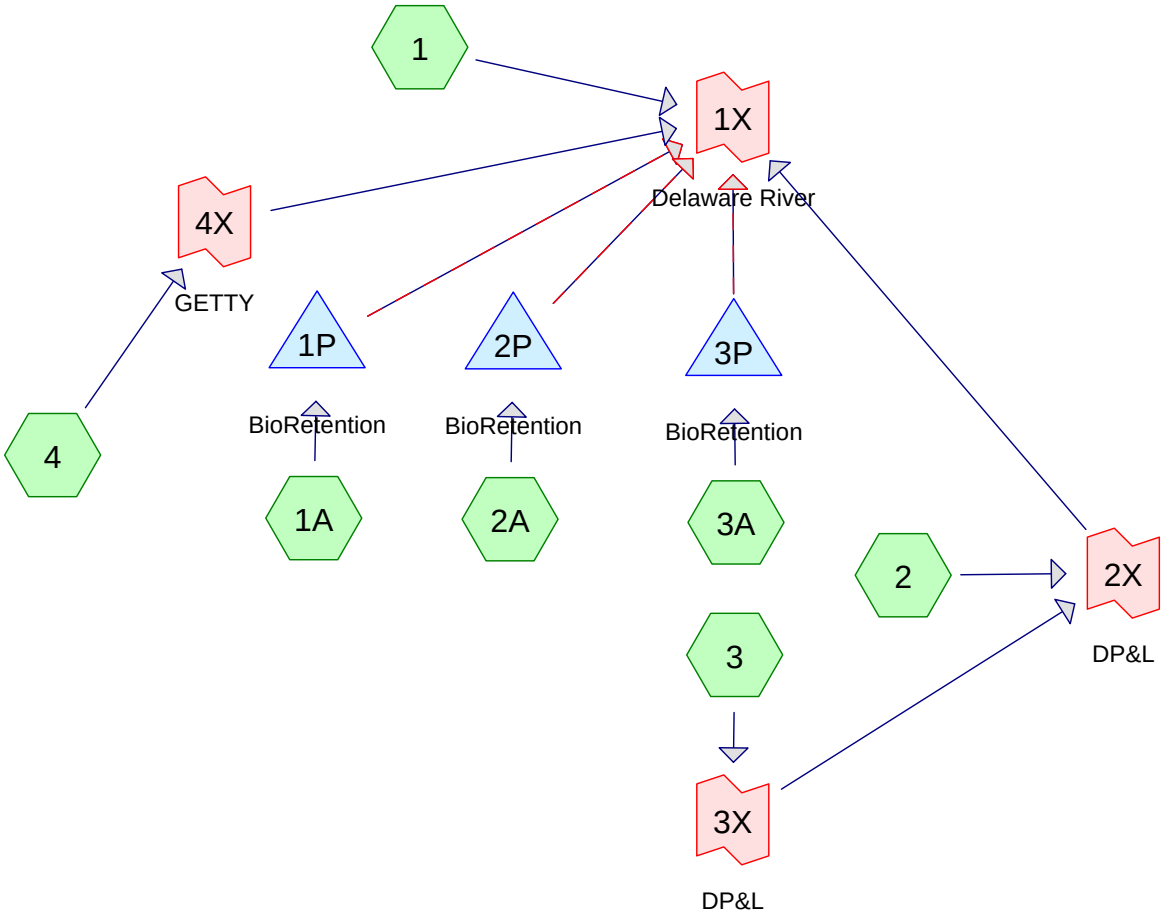
Inflow Area = 6.630 ac, Inflow Depth > 4.35" for 100 yr event
Inflow = 45.04 cfs @ 12.03 hrs, Volume= 2.401 af
Primary = 45.04 cfs @ 12.03 hrs, Volume= 2.401 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 4X: GETTY

Inflow Area = 2.590 ac, Inflow Depth > 4.58" for 100 yr event
Inflow = 22.26 cfs @ 11.96 hrs, Volume= 0.988 af
Primary = 22.26 cfs @ 11.96 hrs, Volume= 0.988 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs



Subcat Reach Pond Link

Drainage Diagram for DSGP 1593 River Rd-POST
Prepared by McBride & Ziegler, Inc. 10/25/2011

Subcatchment 1:

Runoff = 13.40 cfs @ 12.23 hrs, Volume= 1.239 af, Depth> 0.60"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2yr Rainfall=3.20"

Area (ac)	CN	Description
0.180	98	Paved parking & roofs
5.430	61	>75% Grass cover, Good, HSG B
4.100	72	Small grain, SR + CR, Good, HSG B
6.700	55	Woods, Good, HSG B
5.830	77	Woods, Good, HSG D
0.790	80	>75% Grass cover, Good, HSG D
1.590	72	Offsite Small Grain B
0.150	98	Offsite Paved
24.770	67	Weighted Average
24.440		Pervious Area
0.330		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	100	0.0200	0.35		**Sheet Flow, 1-A** Cultivated: Residue<=20% n= 0.060 P2= 3.20"
3.4	245	0.0180	1.21		**Shallow Concentrated Flow, 1-B** Cultivated Straight Rows Kv= 9.0 fps
2.9	315	0.0400	1.80		**Shallow Concentrated Flow, 1-C** Cultivated Straight Rows Kv= 9.0 fps
5.1	1,430	0.0030	4.66	14.64	**Circular Channel (pipe), 1-D** Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011
8.2	205	0.0070	0.42		**Shallow Concentrated Flow, 1-E** Woodland Kv= 5.0 fps
1.1	85	0.0070	1.25		**Shallow Concentrated Flow, 1-F** Grassed Waterway Kv= 15.0 fps
25.4	2,380	Total			

Subcatchment 1A:

Runoff = 7.36 cfs @ 11.97 hrs, Volume= 0.335 af, Depth> 1.78"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2yr Rainfall=3.20"

Area (ac)	CN	Description
1.480	92	Gravel
0.410	61	>75% Grass cover, Good, HSG B
0.370	98	Paved parking & roofs
2.260	87	Weighted Average
1.890		Pervious Area
0.370		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 2:

Runoff = 3.46 cfs @ 12.06 hrs, Volume= 0.210 af, Depth> 0.56"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2yr Rainfall=3.20"

Area (ac)	CN	Description
1.860	58	Woods/grass comb., Good, HSG B
2.610	72	Small grain, SR + CR, Good, HSG B
4.470	66	Weighted Average
4.470		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	80	0.0300	0.40		**Sheet Flow, 2-A** Cultivated: Residue<=20% n= 0.060 P2= 3.20"
5.9	230	0.0170	0.65		**Shallow Concentrated Flow, 2-B** Woodland Kv= 5.0 fps
3.2	205	0.0450	1.06		**Shallow Concentrated Flow, 2-C** Woodland Kv= 5.0 fps
12.4	515	Total			

Subcatchment 2A:

Runoff = 12.25 cfs @ 11.97 hrs, Volume= 0.566 af, Depth> 1.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2yr Rainfall=3.20"

Area (ac)	CN	Description
3.120	92	Gravel
0.380	61	>75% Grass cover, Good, HSG B
3.500	89	Weighted Average
3.500		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 3:

Runoff = 8.60 cfs @ 12.04 hrs, Volume= 0.460 af, Depth> 0.83"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2yr Rainfall=3.20"

Area (ac)	CN	Description
6.630	72	Small grain, SR + CR, Good, HSG B
6.630		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	100	0.0100	0.27		**Sheet Flow, 3-A** Cultivated: Residue<=20% n= 0.060 P2= 3.20"
0.9	60	0.0160	1.14		**Shallow Concentrated Flow, 3-B** Cultivated Straight Rows Kv= 9.0 fps
4.1	315	0.0200	1.27		**Shallow Concentrated Flow, 3-C** Cultivated Straight Rows Kv= 9.0 fps
11.2	475	Total			

Subcatchment 3A:

Runoff = 6.66 cfs @ 11.97 hrs, Volume= 0.310 af, Depth> 2.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2yr Rainfall=3.20"

Area (ac)	CN	Description
1.700	92	Gravel
0.130	61	>75% Grass cover, Good, HSG B
0.010	80	>75% Grass cover, Good, HSG D
1.840	90	Weighted Average
1.840		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 4:

Runoff = 1.11 cfs @ 11.98 hrs, Volume= 0.048 af, Depth> 1.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2yr Rainfall=3.20"

Area (ac)	CN	Description
0.270	61	>75% Grass cover, Good, HSG B
0.200	98	Paved parking & roofs
0.030	98	Offsite Paved
0.500	78	Weighted Average
0.270		Pervious Area
0.230		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Pond 1P: BioRetention

Inflow Area = 2.260 ac, Inflow Depth > 1.78" for 2yr event
Inflow = 7.36 cfs @ 11.97 hrs, Volume= 0.335 af
Outflow = 7.16 cfs @ 12.02 hrs, Volume= 0.261 af, Atten= 3%, Lag= 2.8 min
Discarded = 0.19 cfs @ 12.02 hrs, Volume= 0.130 af
Secondary = 6.98 cfs @ 12.02 hrs, Volume= 0.132 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 19.77' @ 12.02 hrs Surf.Area= 3,273 sf Storage= 4,554 cf

Plug-Flow detention time= 98.3 min calculated for 0.261 af (78% of inflow)
Center-of-Mass det. time= 41.1 min (817.8 - 776.7)

Volume	Invert	Avail.Storage	Storage Description
#1	15.75'	9,968 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
15.75	1,886	40.0	0	0
16.00	1,886	40.0	189	189
17.00	1,886	40.0	754	943
18.00	1,886	40.0	754	1,697
18.90	1,886	40.0	679	2,376
19.00	1,886	100.0	189	2,565
20.00	3,685	100.0	2,786	5,350
21.00	5,550	100.0	4,618	9,968

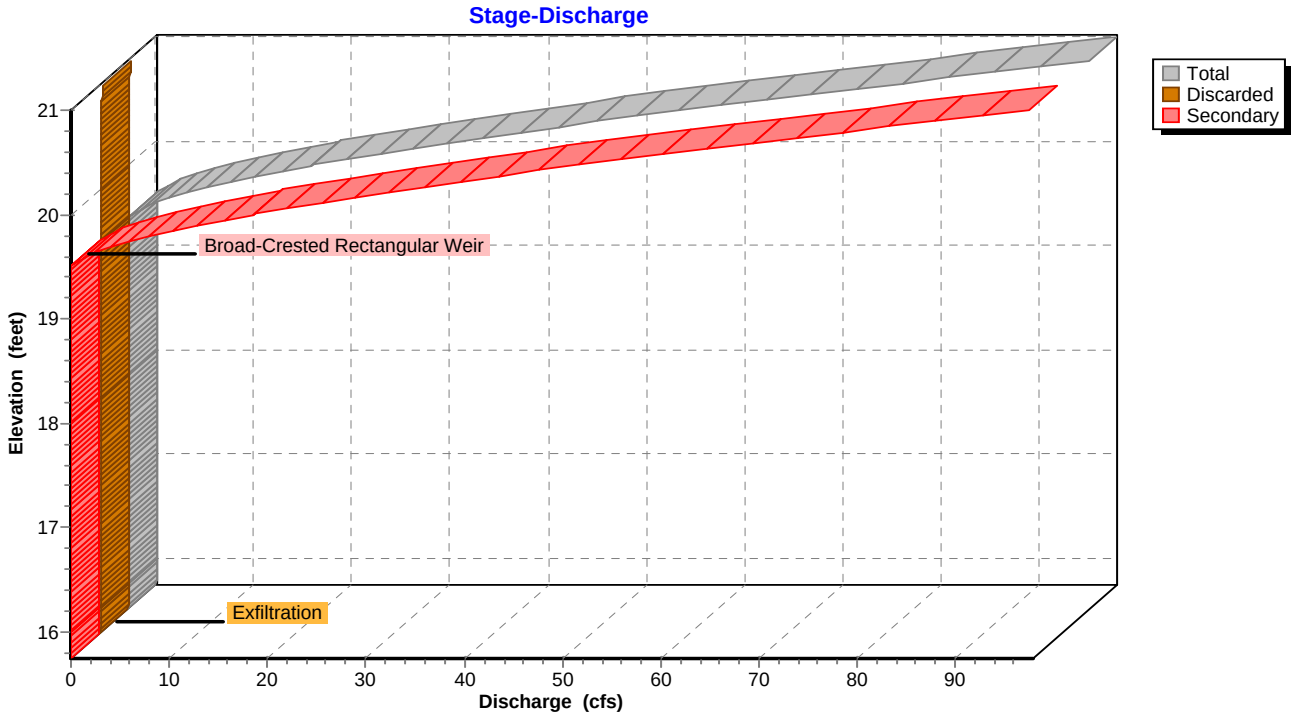
Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.500 in/hr Exfiltration over Surface area**
#2	Secondary	19.50'	**20.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=0.19 cfs @ 12.02 hrs HW=19.75' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.19 cfs)

Secondary OutFlow Max=6.24 cfs @ 12.02 hrs HW=19.75' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 6.24 cfs @ 1.25 fps)

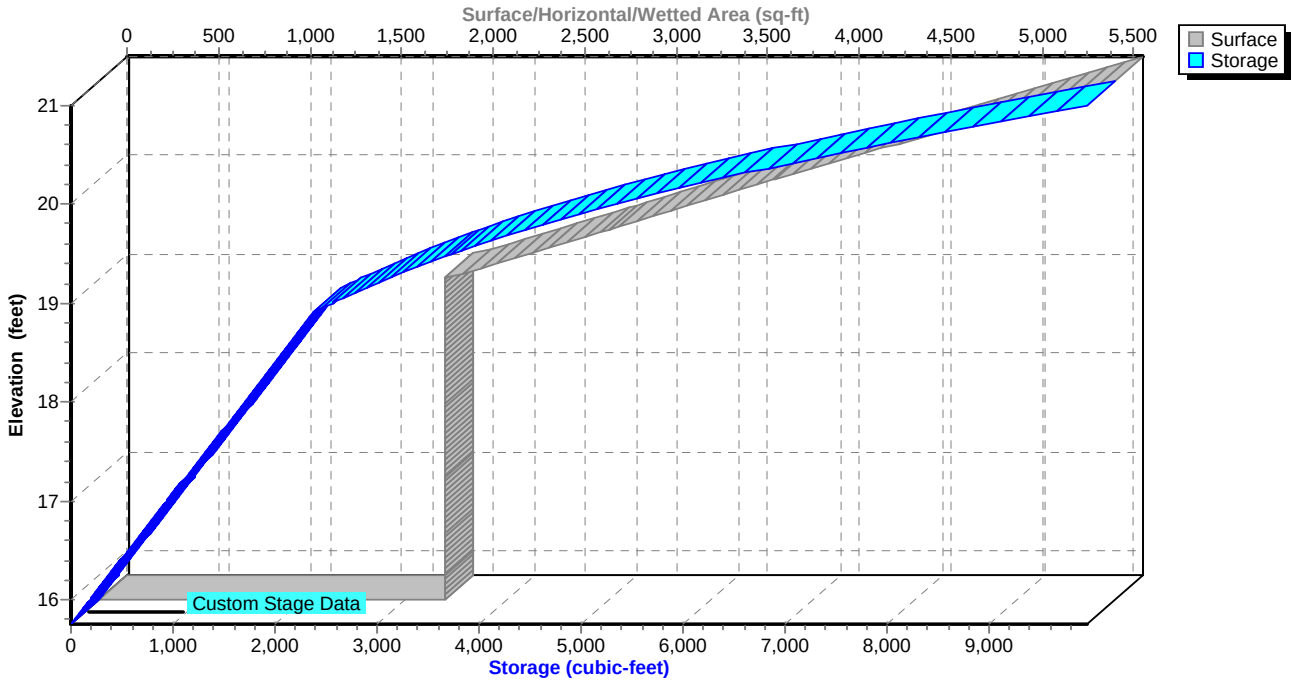
Pond 1P: BioRetention

Stage-Discharge



Pond 1P: BioRetention

Stage-Area-Storage



Pond 2P: BioRetention

Inflow Area = 3.500 ac, Inflow Depth > 1.94" for 2yr event
Inflow = 12.25 cfs @ 11.97 hrs, Volume= 0.566 af
Outflow = 11.80 cfs @ 12.02 hrs, Volume= 0.449 af, Atten= 4%, Lag= 2.9 min
Discarded = 0.38 cfs @ 12.02 hrs, Volume= 0.246 af
Secondary = 11.43 cfs @ 12.02 hrs, Volume= 0.203 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 16.73' @ 12.02 hrs Surf.Area= 6,483 sf Storage= 7,900 cf

Plug-Flow detention time= 102.3 min calculated for 0.449 af (79% of inflow)
Center-of-Mass det. time= 46.6 min (817.0 - 770.4)

Volume	Invert	Avail.Storage	Storage Description
#1	12.75'	18,964 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
12.75	3,200	40.0	0	0
13.00	3,200	40.0	320	320
14.00	3,200	40.0	1,280	1,600
15.00	3,200	40.0	1,280	2,880
15.90	3,200	40.0	1,152	4,032
16.00	3,200	100.0	320	4,352
17.00	7,680	100.0	5,440	9,792
18.00	10,664	100.0	9,172	18,964

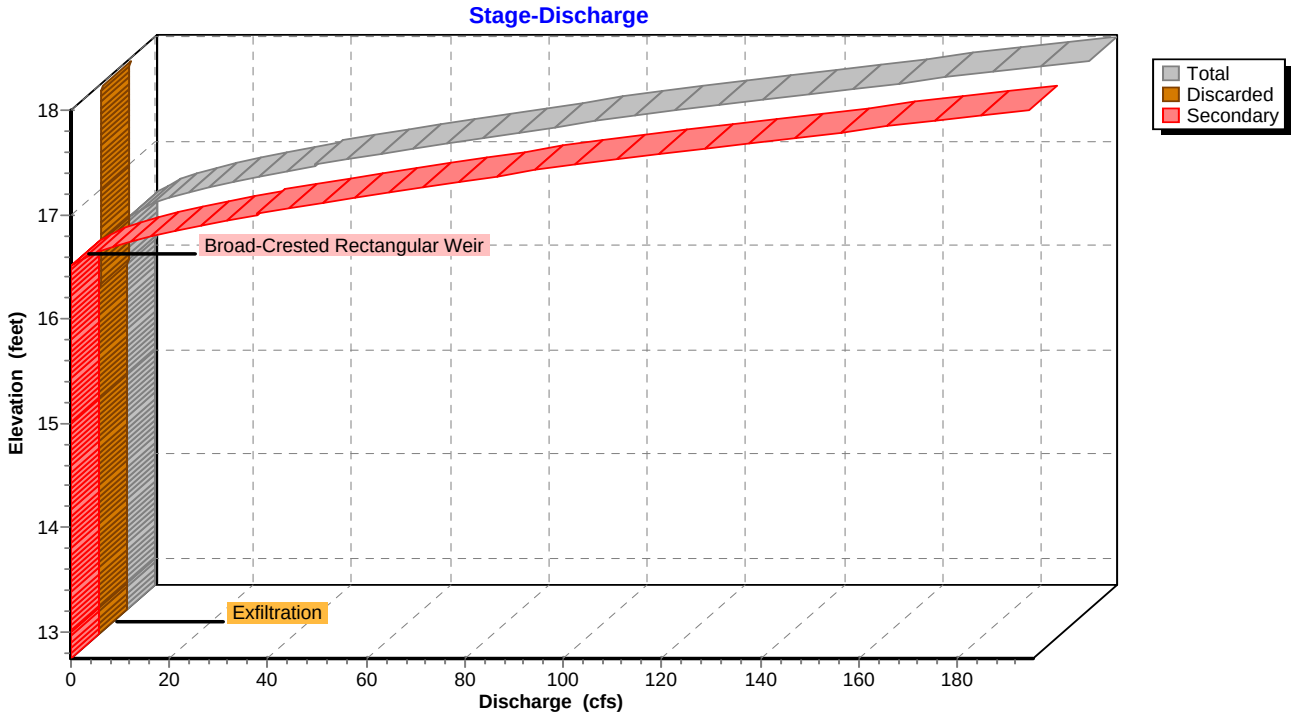
Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.500 in/hr Exfiltration over Surface area**
#2	Secondary	16.50'	**40.0' long x 12.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Discarded OutFlow Max=0.37 cfs @ 12.02 hrs HW=16.71' (Free Discharge)
↑└**1=Exfiltration** (Exfiltration Controls 0.37 cfs)

Secondary OutFlow Max=10.24 cfs @ 12.02 hrs HW=16.71' (Free Discharge)
↑└**2=Broad-Crested Rectangular Weir** (Weir Controls 10.24 cfs @ 1.19 fps)

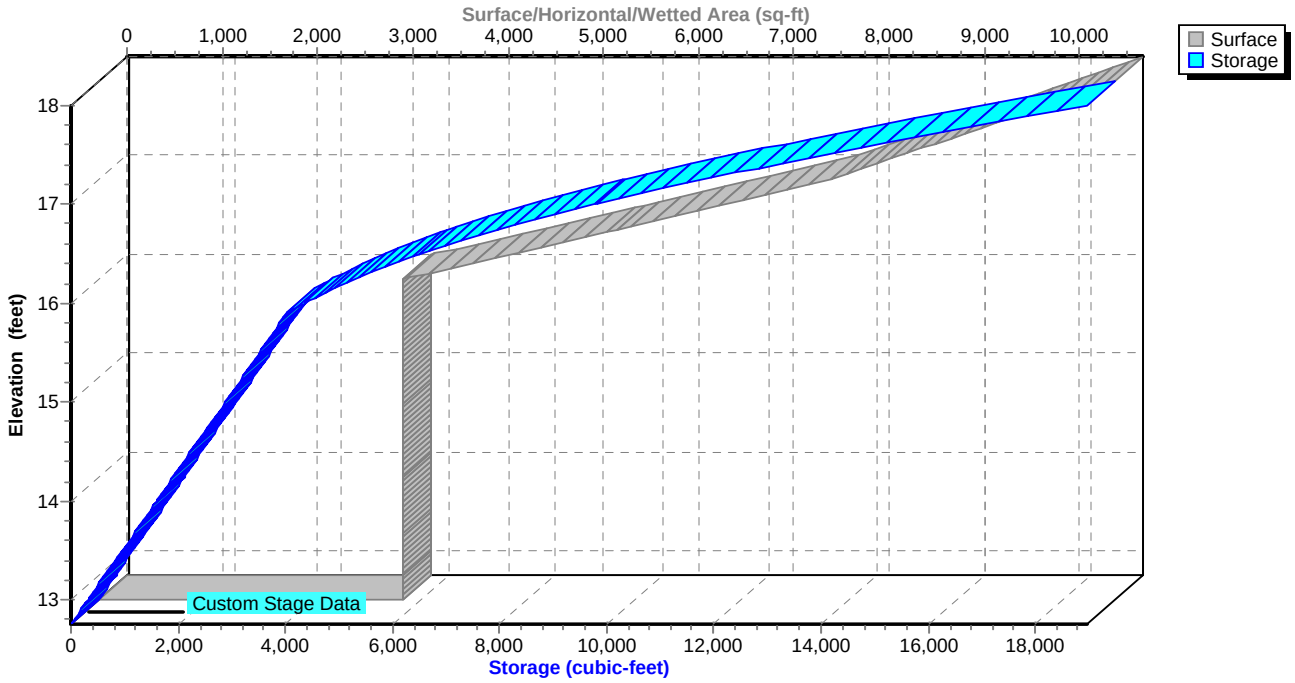
Pond 2P: BioRetention

Stage-Discharge



Pond 2P: BioRetention

Stage-Area-Storage



Pond 3P: BioRetention

Inflow Area = 1.840 ac, Inflow Depth > 2.02" for 2yr event
Inflow = 6.66 cfs @ 11.97 hrs, Volume= 0.310 af
Outflow = 7.29 cfs @ 12.01 hrs, Volume= 0.243 af, Atten= 0%, Lag= 2.6 min
Primary = 0.19 cfs @ 12.01 hrs, Volume= 0.135 af
Secondary = 7.10 cfs @ 12.01 hrs, Volume= 0.108 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 16.70' @ 12.01 hrs Surf.Area= 2,970 sf Storage= 4,326 cf

Plug-Flow detention time= 106.5 min calculated for 0.242 af (78% of inflow)
Center-of-Mass det. time= 50.1 min (817.1 - 767.0)

Volume	Invert	Avail.Storage	Storage Description
#1	12.25'	9,506 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
12.25	1,720	40.0	0	0
13.00	1,720	40.0	516	516
14.00	1,720	40.0	688	1,204
15.00	1,720	40.0	688	1,892
15.90	1,720	40.0	619	2,511
16.00	1,720	100.0	172	2,683
17.00	3,503	100.0	2,612	5,295
18.00	4,920	100.0	4,212	9,506

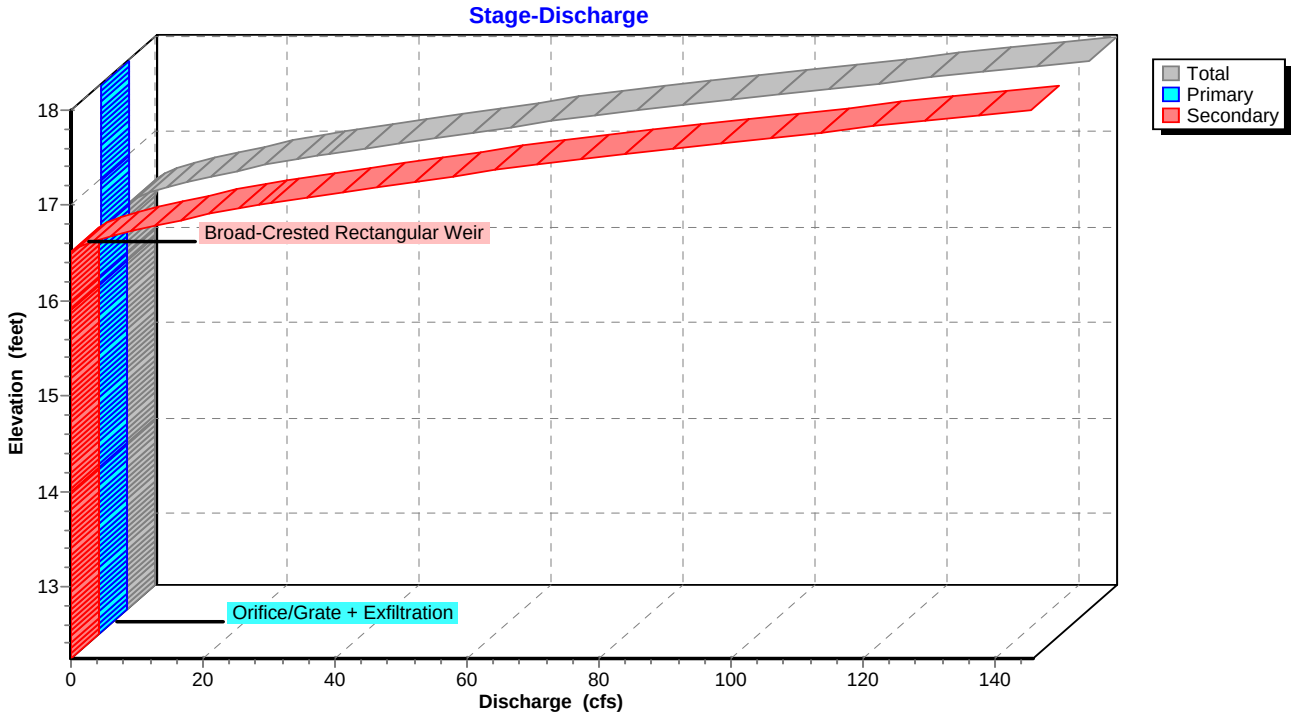
Device	Routing	Invert	Outlet Devices
#1	Primary	12.25'	**4.0" Vert. Orifice/Grate** C= 0.600
#2	Device 1	0.00'	**2.830 in/hr Exfiltration over Surface area**
#3	Secondary	16.50'	**30.0' long x 14.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.64 2.67 2.70 2.65 2.64 2.65 2.65 2.63

Primary OutFlow Max=0.19 cfs @ 12.01 hrs HW=16.69' (Free Discharge)
└**1=Orifice/Grate** (Passes 0.19 cfs of 0.87 cfs potential flow)
└**2=Exfiltration** (Exfiltration Controls 0.19 cfs)

Secondary OutFlow Max=6.40 cfs @ 12.01 hrs HW=16.69' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 6.40 cfs @ 1.14 fps)

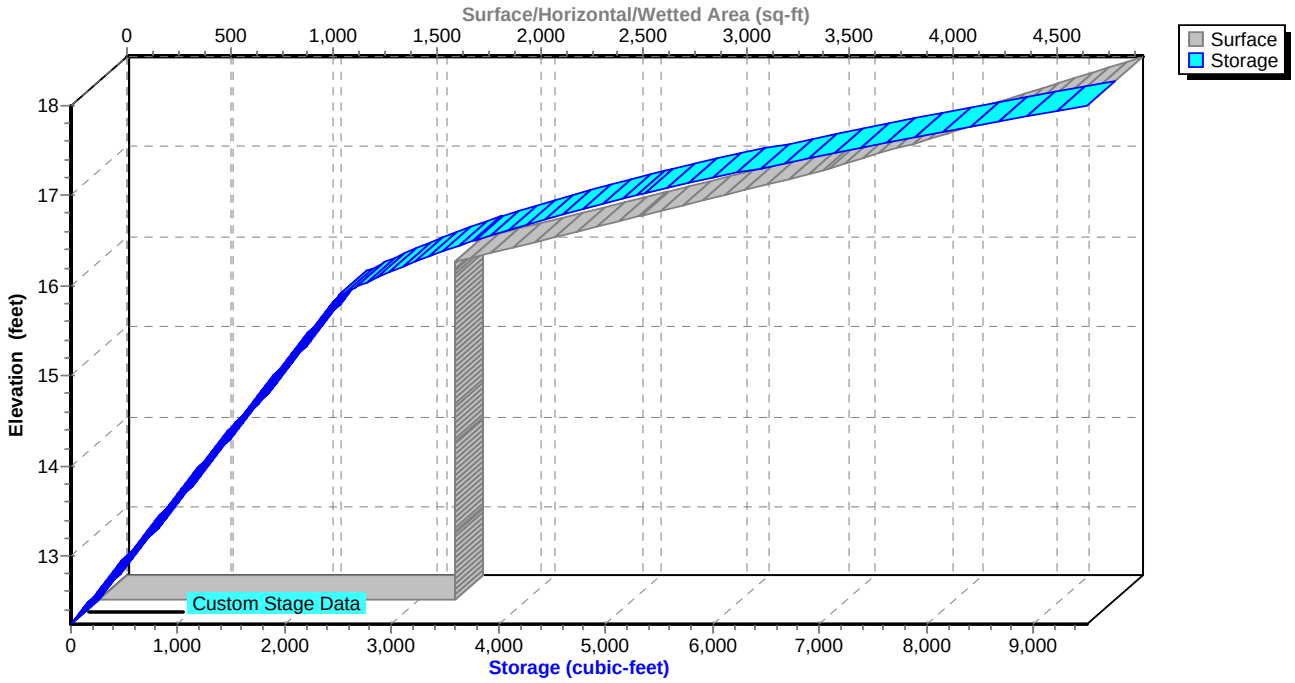
Pond 3P: BioRetention

Stage-Discharge



Pond 3P: BioRetention

Stage-Area-Storage



Link 1X: Delaware River

Inflow Area = 43.970 ac, Inflow Depth > 0.69" for 2yr event
Inflow = 42.91 cfs @ 12.02 hrs, Volume= 2.534 af
Primary = 42.91 cfs @ 12.02 hrs, Volume= 2.534 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 2X: DP&L

Inflow Area = 11.100 ac, Inflow Depth > 0.72" for 2yr event
Inflow = 12.00 cfs @ 12.05 hrs, Volume= 0.670 af
Primary = 12.00 cfs @ 12.05 hrs, Volume= 0.670 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 3X: DP&L

Inflow Area = 6.630 ac, Inflow Depth > 0.83" for 2yr event
Inflow = 8.60 cfs @ 12.04 hrs, Volume= 0.460 af
Primary = 8.60 cfs @ 12.04 hrs, Volume= 0.460 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 4X: GETTY

Inflow Area = 0.500 ac, Inflow Depth > 1.16" for 2yr event
Inflow = 1.11 cfs @ 11.98 hrs, Volume= 0.048 af
Primary = 1.11 cfs @ 11.98 hrs, Volume= 0.048 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Subcatchment 1:

Runoff = 37.70 cfs @ 12.21 hrs, Volume= 3.084 af, Depth> 1.49"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10yr Rainfall=4.80"

Area (ac)	CN	Description
0.180	98	Paved parking & roofs
5.430	61	>75% Grass cover, Good, HSG B
4.100	72	Small grain, SR + CR, Good, HSG B
6.700	55	Woods, Good, HSG B
5.830	77	Woods, Good, HSG D
0.790	80	>75% Grass cover, Good, HSG D
1.590	72	Offsite Small Grain B
0.150	98	Offsite Paved
24.770	67	Weighted Average
24.440		Pervious Area
0.330		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	100	0.0200	0.35		**Sheet Flow, 1-A** Cultivated: Residue<=20% n= 0.060 P2= 3.20"
3.4	245	0.0180	1.21		**Shallow Concentrated Flow, 1-B** Cultivated Straight Rows Kv= 9.0 fps
2.9	315	0.0400	1.80		**Shallow Concentrated Flow, 1-C** Cultivated Straight Rows Kv= 9.0 fps
5.1	1,430	0.0030	4.66	14.64	**Circular Channel (pipe), 1-D** Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011
8.2	205	0.0070	0.42		**Shallow Concentrated Flow, 1-E** Woodland Kv= 5.0 fps
1.1	85	0.0070	1.25		**Shallow Concentrated Flow, 1-F** Grassed Waterway Kv= 15.0 fps
25.4	2,380	Total			

Subcatchment 1A:

Runoff = 12.65 cfs @ 11.97 hrs, Volume= 0.595 af, Depth> 3.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10yr Rainfall=4.80"

Area (ac)	CN	Description
1.480	92	Gravel
0.410	61	>75% Grass cover, Good, HSG B
0.370	98	Paved parking & roofs
2.260	87	Weighted Average
1.890		Pervious Area
0.370		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 2:

Runoff = 9.70 cfs @ 12.05 hrs, Volume= 0.534 af, Depth> 1.43"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10yr Rainfall=4.80"

Area (ac)	CN	Description
1.860	58	Woods/grass comb., Good, HSG B
2.610	72	Small grain, SR + CR, Good, HSG B
4.470	66	Weighted Average
4.470		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	80	0.0300	0.40		**Sheet Flow, 2-A** Cultivated: Residue<=20% n= 0.060 P2= 3.20"
5.9	230	0.0170	0.65		**Shallow Concentrated Flow, 2-B** Woodland Kv= 5.0 fps
3.2	205	0.0450	1.06		**Shallow Concentrated Flow, 2-C** Woodland Kv= 5.0 fps
12.4	515	Total			

Subcatchment 2A:

Runoff = 20.47 cfs @ 11.97 hrs, Volume= 0.979 af, Depth> 3.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10yr Rainfall=4.80"

Area (ac)	CN	Description
3.120	92	Gravel
0.380	61	>75% Grass cover, Good, HSG B
3.500	89	Weighted Average
3.500		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 3:

Runoff = 19.69 cfs @ 12.03 hrs, Volume= 1.030 af, Depth> 1.86"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10yr Rainfall=4.80"

Area (ac)	CN	Description
6.630	72	Small grain, SR + CR, Good, HSG B
6.630		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	100	0.0100	0.27		**Sheet Flow, 3-A** Cultivated: Residue<=20% n= 0.060 P2= 3.20"
0.9	60	0.0160	1.14		**Shallow Concentrated Flow, 3-B** Cultivated Straight Rows Kv= 9.0 fps
4.1	315	0.0200	1.27		**Shallow Concentrated Flow, 3-C** Cultivated Straight Rows Kv= 9.0 fps
11.2	475	Total			

Subcatchment 3A:

Runoff = 10.98 cfs @ 11.96 hrs, Volume= 0.530 af, Depth> 3.45"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10yr Rainfall=4.80"

Area (ac)	CN	Description
1.700	92	Gravel
0.130	61	>75% Grass cover, Good, HSG B
0.010	80	>75% Grass cover, Good, HSG D
1.840	90	Weighted Average
1.840		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 4:

Runoff = 2.18 cfs @ 11.97 hrs, Volume= 0.098 af, Depth> 2.35"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10yr Rainfall=4.80"

Area (ac)	CN	Description
0.270	61	>75% Grass cover, Good, HSG B
0.200	98	Paved parking & roofs
0.030	98	Offsite Paved
0.500	78	Weighted Average
0.270		Pervious Area
0.230		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Pond 1P: BioRetention

Inflow Area = 2.260 ac, Inflow Depth > 3.16" for 10yr event
Inflow = 12.65 cfs @ 11.97 hrs, Volume= 0.595 af
Outflow = 12.40 cfs @ 11.99 hrs, Volume= 0.511 af, Atten= 2%, Lag= 1.3 min
Discarded = 0.20 cfs @ 11.99 hrs, Volume= 0.151 af
Secondary = 12.20 cfs @ 11.99 hrs, Volume= 0.359 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 19.88' @ 11.99 hrs Surf.Area= 3,477 sf Storage= 4,937 cf

Plug-Flow detention time= 61.9 min calculated for 0.511 af (86% of inflow)
Center-of-Mass det. time= 17.6 min (781.0 - 763.5)

Volume	Invert	Avail.Storage	Storage Description
#1	15.75'	9,968 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

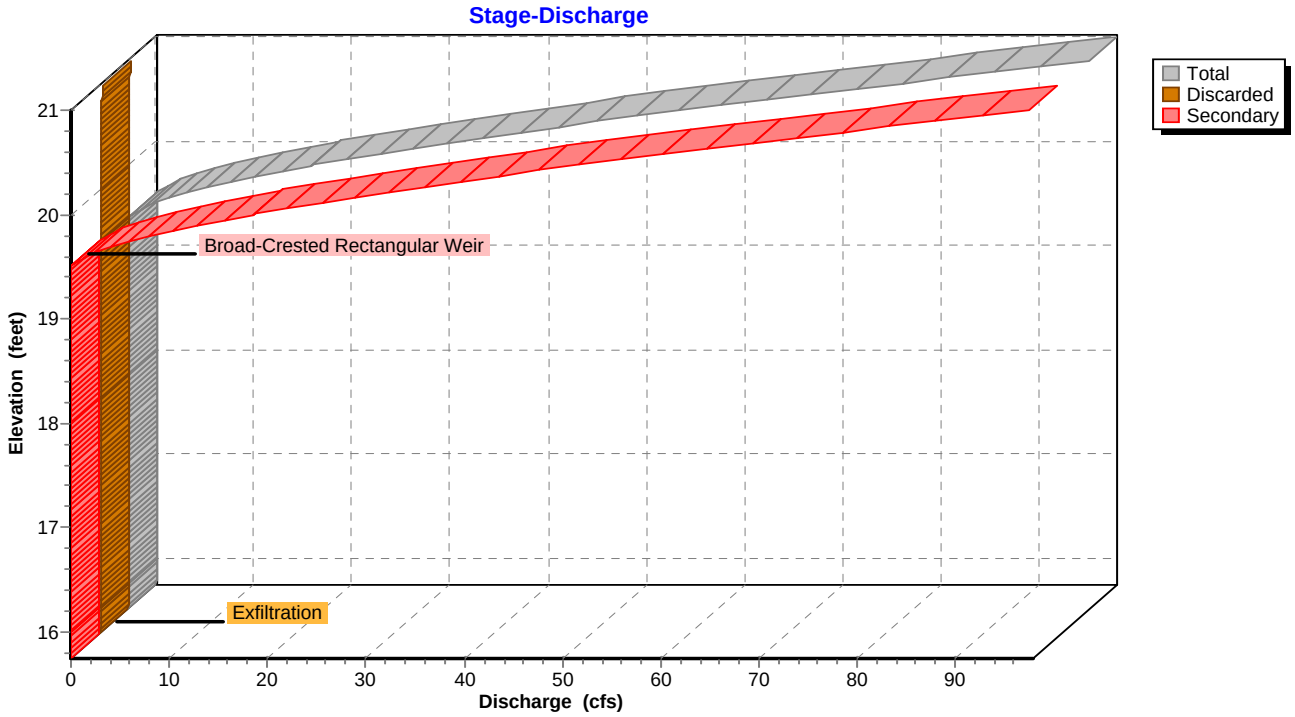
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
15.75	1,886	40.0	0	0
16.00	1,886	40.0	189	189
17.00	1,886	40.0	754	943
18.00	1,886	40.0	754	1,697
18.90	1,886	40.0	679	2,376
19.00	1,886	100.0	189	2,565
20.00	3,685	100.0	2,786	5,350
21.00	5,550	100.0	4,618	9,968

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.500 in/hr Exfiltration over Surface area**
#2	Secondary	19.50'	**20.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

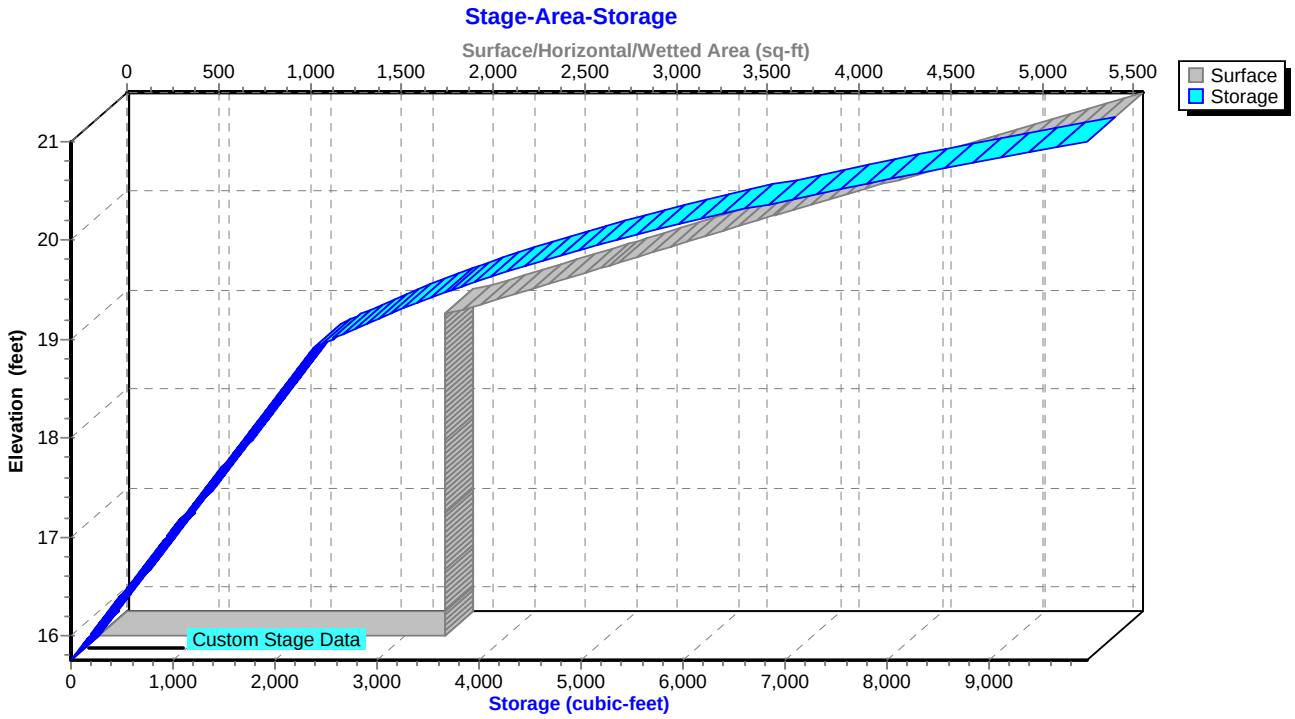
Discarded OutFlow Max=0.20 cfs @ 11.99 hrs HW=19.88' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.20 cfs)

Secondary OutFlow Max=11.81 cfs @ 11.99 hrs HW=19.88' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 11.81 cfs @ 1.57 fps)

Pond 1P: BioRetention



Pond 1P: BioRetention



Pond 2P: BioRetention

Inflow Area = 3.500 ac, Inflow Depth > 3.36" for 10yr event
Inflow = 20.47 cfs @ 11.97 hrs, Volume= 0.979 af
Outflow = 19.99 cfs @ 11.99 hrs, Volume= 0.839 af, Atten= 2%, Lag= 1.3 min
Discarded = 0.40 cfs @ 11.99 hrs, Volume= 0.291 af
Secondary = 19.59 cfs @ 11.99 hrs, Volume= 0.547 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 16.83' @ 11.99 hrs Surf.Area= 6,910 sf Storage= 8,538 cf

Plug-Flow detention time= 65.2 min calculated for 0.836 af (85% of inflow)
Center-of-Mass det. time= 21.4 min (779.2 - 757.8)

Volume	Invert	Avail.Storage	Storage Description
#1	12.75'	18,964 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
12.75	3,200	40.0	0	0
13.00	3,200	40.0	320	320
14.00	3,200	40.0	1,280	1,600
15.00	3,200	40.0	1,280	2,880
15.90	3,200	40.0	1,152	4,032
16.00	3,200	100.0	320	4,352
17.00	7,680	100.0	5,440	9,792
18.00	10,664	100.0	9,172	18,964

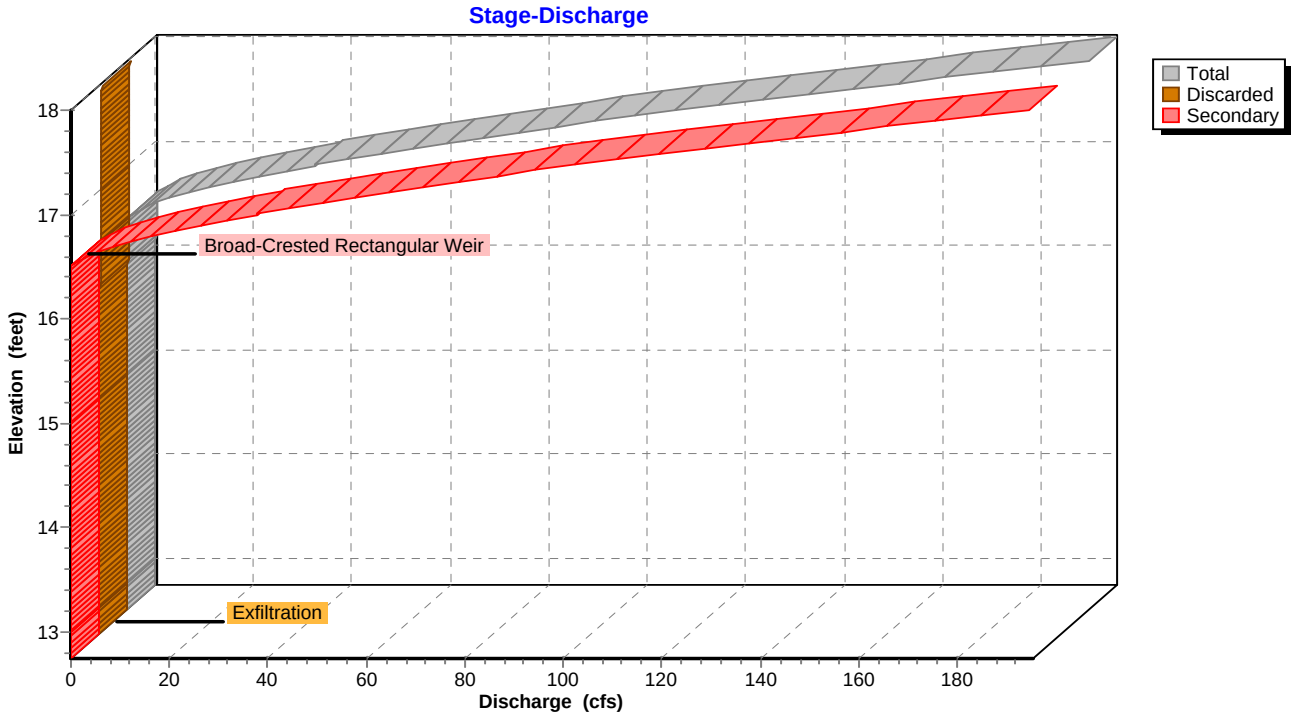
Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.500 in/hr Exfiltration over Surface area**
#2	Secondary	16.50'	**40.0' long x 12.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Discarded OutFlow Max=0.40 cfs @ 11.99 hrs HW=16.82' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.40 cfs)

Secondary OutFlow Max=18.97 cfs @ 11.99 hrs HW=16.82' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 18.97 cfs @ 1.47 fps)

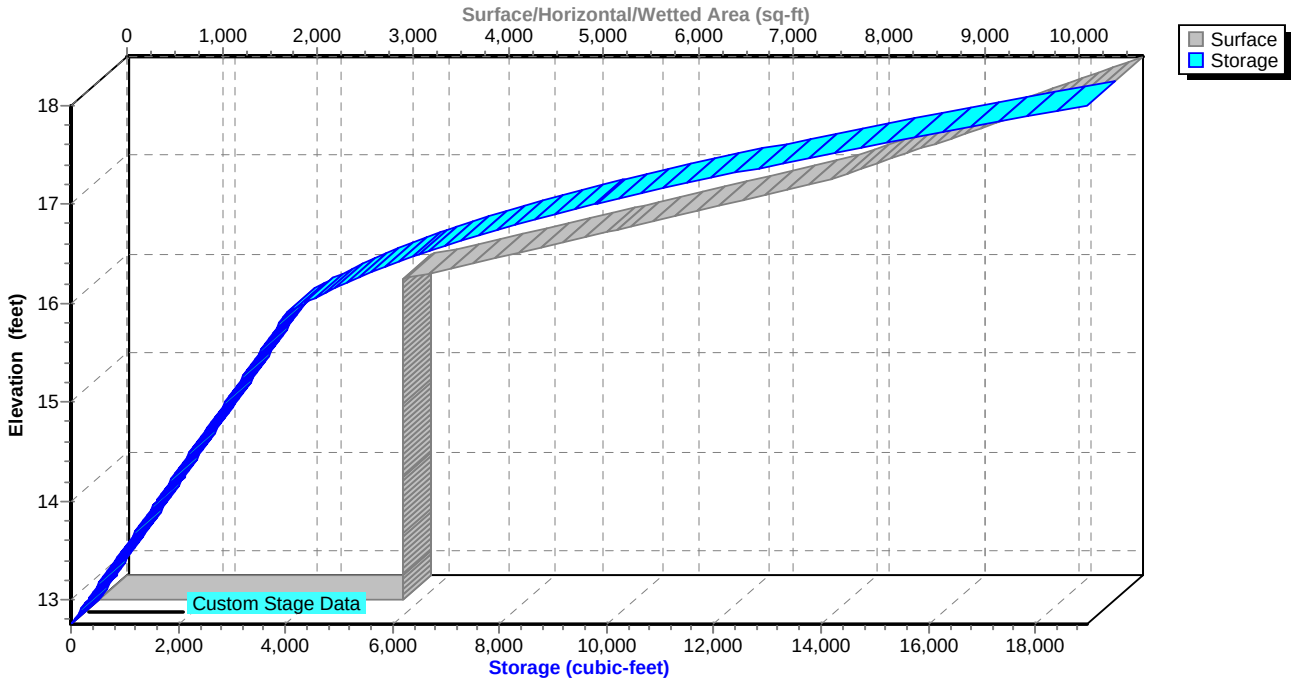
Pond 2P: BioRetention

Stage-Discharge



Pond 2P: BioRetention

Stage-Area-Storage



Pond 3P: BioRetention

Inflow Area = 1.840 ac, Inflow Depth > 3.45" for 10yr event
Inflow = 10.98 cfs @ 11.96 hrs, Volume= 0.530 af
Outflow = 10.88 cfs @ 11.98 hrs, Volume= 0.449 af, Atten= 1%, Lag= 1.0 min
Primary = 0.20 cfs @ 11.98 hrs, Volume= 0.160 af
Secondary = 10.68 cfs @ 11.98 hrs, Volume= 0.289 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 16.76' @ 11.98 hrs Surf.Area= 3,078 sf Storage= 4,511 cf

Plug-Flow detention time= 70.0 min calculated for 0.449 af (85% of inflow)
Center-of-Mass det. time= 23.5 min (778.4 - 754.9)

Volume	Invert	Avail.Storage	Storage Description
#1	12.25'	9,506 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
12.25	1,720	40.0	0	0
13.00	1,720	40.0	516	516
14.00	1,720	40.0	688	1,204
15.00	1,720	40.0	688	1,892
15.90	1,720	40.0	619	2,511
16.00	1,720	100.0	172	2,683
17.00	3,503	100.0	2,612	5,295
18.00	4,920	100.0	4,212	9,506

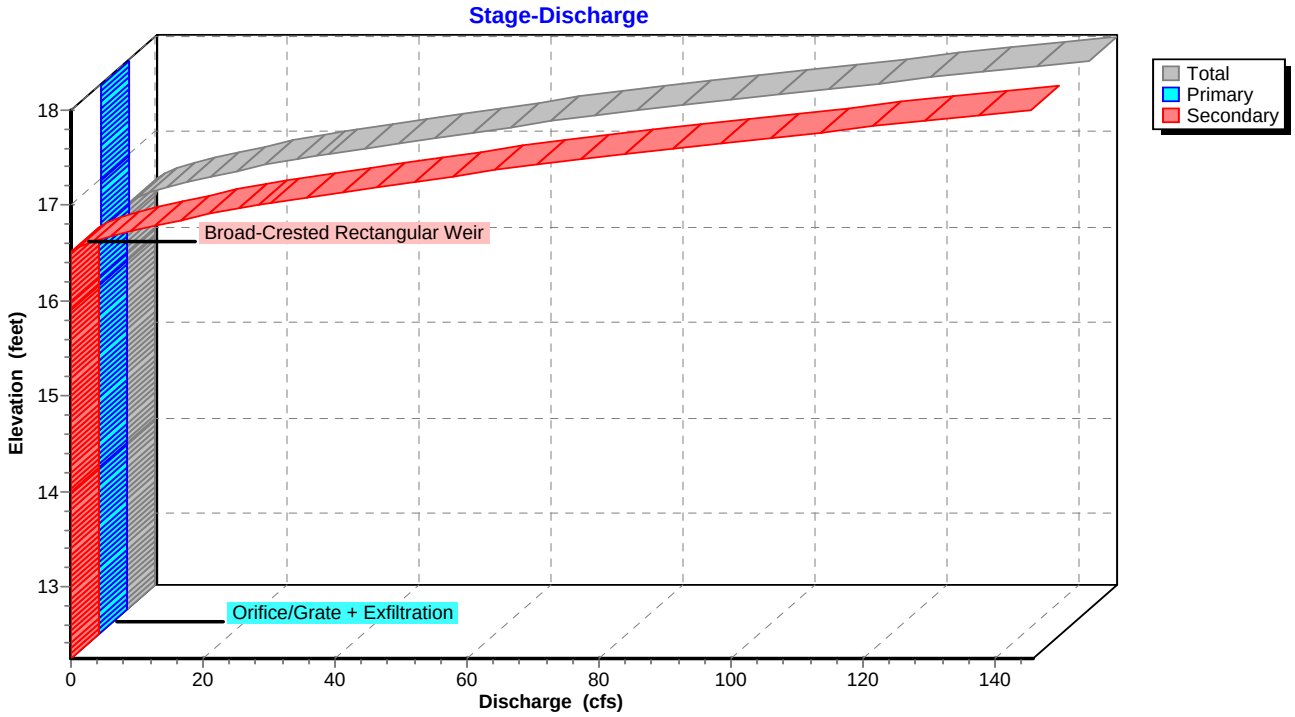
Device	Routing	Invert	Outlet Devices
#1	Primary	12.25'	**4.0" Vert. Orifice/Grate** C= 0.600
#2	Device 1	0.00'	**2.830 in/hr Exfiltration over Surface area**
#3	Secondary	16.50'	**30.0' long x 14.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.64 2.67 2.70 2.65 2.64 2.65 2.65 2.63

Primary OutFlow Max=0.20 cfs @ 11.98 hrs HW=16.76' (Free Discharge)
└**1=Orifice/Grate** (Passes 0.20 cfs of 0.88 cfs potential flow)
└**2=Exfiltration** (Exfiltration Controls 0.20 cfs)

Secondary OutFlow Max=10.24 cfs @ 11.98 hrs HW=16.76' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 10.24 cfs @ 1.34 fps)

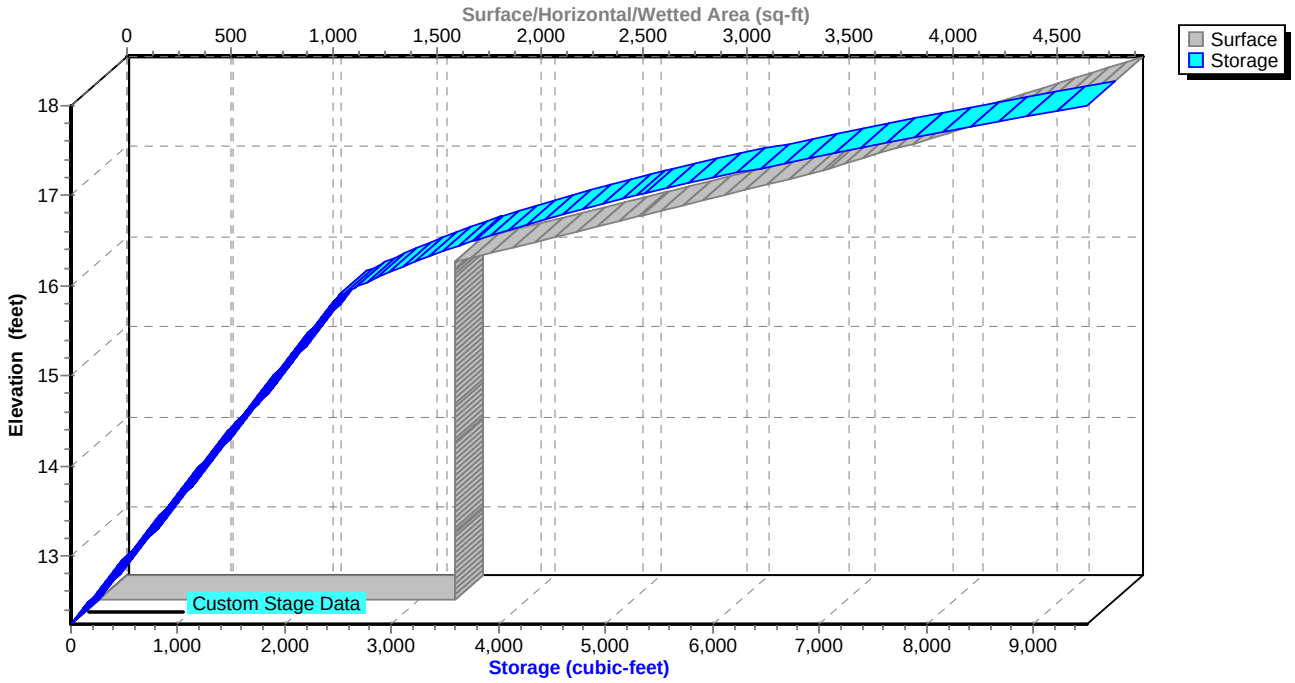
Pond 3P: BioRetention

Stage-Discharge



Pond 3P: BioRetention

Stage-Area-Storage



Link 1X: Delaware River

Inflow Area = 43.970 ac, Inflow Depth > 1.67" for 10yr event
Inflow = 89.58 cfs @ 12.02 hrs, Volume= 6.102 af
Primary = 89.58 cfs @ 12.02 hrs, Volume= 6.102 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 2X: DP&L

Inflow Area = 11.100 ac, Inflow Depth > 1.69" for 10yr event
Inflow = 29.30 cfs @ 12.04 hrs, Volume= 1.565 af
Primary = 29.30 cfs @ 12.04 hrs, Volume= 1.565 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 3X: DP&L

Inflow Area = 6.630 ac, Inflow Depth > 1.86" for 10yr event
Inflow = 19.69 cfs @ 12.03 hrs, Volume= 1.030 af
Primary = 19.69 cfs @ 12.03 hrs, Volume= 1.030 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 4X: GETTY

Inflow Area = 0.500 ac, Inflow Depth > 2.35" for 10yr event
Inflow = 2.18 cfs @ 11.97 hrs, Volume= 0.098 af
Primary = 2.18 cfs @ 11.97 hrs, Volume= 0.098 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Subcatchment 1:

Runoff = 97.83 cfs @ 12.19 hrs, Volume= 7.786 af, Depth> 3.77"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 yr Rainfall=8.00"

Area (ac)	CN	Description
0.180	98	Paved parking & roofs
5.430	61	>75% Grass cover, Good, HSG B
4.100	72	Small grain, SR + CR, Good, HSG B
6.700	55	Woods, Good, HSG B
5.830	77	Woods, Good, HSG D
0.790	80	>75% Grass cover, Good, HSG D
1.590	72	Offsite Small Grain B
0.150	98	Offsite Paved
24.770	67	Weighted Average
24.440		Pervious Area
0.330		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	100	0.0200	0.35		**Sheet Flow, 1-A** Cultivated: Residue<=20% n= 0.060 P2= 3.20"
3.4	245	0.0180	1.21		**Shallow Concentrated Flow, 1-B** Cultivated Straight Rows Kv= 9.0 fps
2.9	315	0.0400	1.80		**Shallow Concentrated Flow, 1-C** Cultivated Straight Rows Kv= 9.0 fps
5.1	1,430	0.0030	4.66	14.64	**Circular Channel (pipe), 1-D** Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011
8.2	205	0.0070	0.42		**Shallow Concentrated Flow, 1-E** Woodland Kv= 5.0 fps
1.1	85	0.0070	1.25		**Shallow Concentrated Flow, 1-F** Grassed Waterway Kv= 15.0 fps
25.4	2,380	Total			

Subcatchment 1A:

Runoff = 23.22 cfs @ 11.96 hrs, Volume= 1.139 af, Depth> 6.05"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 yr Rainfall=8.00"

Area (ac)	CN	Description
1.480	92	Gravel
0.410	61	>75% Grass cover, Good, HSG B
0.370	98	Paved parking & roofs
2.260	87	Weighted Average
1.890		Pervious Area
0.370		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 2:

Runoff = 25.11 cfs @ 12.04 hrs, Volume= 1.371 af, Depth> 3.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 yr Rainfall=8.00"

Area (ac)	CN	Description
1.860	58	Woods/grass comb., Good, HSG B
2.610	72	Small grain, SR + CR, Good, HSG B
4.470	66	Weighted Average
4.470		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	80	0.0300	0.40		**Sheet Flow, 2-A** Cultivated: Residue<=20% n= 0.060 P2= 3.20"
5.9	230	0.0170	0.65		**Shallow Concentrated Flow, 2-B** Woodland Kv= 5.0 fps
3.2	205	0.0450	1.06		**Shallow Concentrated Flow, 2-C** Woodland Kv= 5.0 fps
12.4	515	Total			

Subcatchment 2A:

Runoff = 36.74 cfs @ 11.96 hrs, Volume= 1.827 af, Depth> 6.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 yr Rainfall=8.00"

Area (ac)	CN	Description
3.120	92	Gravel
0.380	61	>75% Grass cover, Good, HSG B
3.500	89	Weighted Average
3.500		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 3:

Runoff = 45.04 cfs @ 12.03 hrs, Volume= 2.401 af, Depth> 4.35"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 yr Rainfall=8.00"

Area (ac)	CN	Description
6.630	72	Small grain, SR + CR, Good, HSG B
6.630		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	100	0.0100	0.27		**Sheet Flow, 3-A** Cultivated: Residue<=20% n= 0.060 P2= 3.20"
0.9	60	0.0160	1.14		**Shallow Concentrated Flow, 3-B** Cultivated Straight Rows Kv= 9.0 fps
4.1	315	0.0200	1.27		**Shallow Concentrated Flow, 3-C** Cultivated Straight Rows Kv= 9.0 fps
11.2	475	Total			

Subcatchment 3A:

Runoff = 19.50 cfs @ 11.96 hrs, Volume= 0.977 af, Depth> 6.37"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 yr Rainfall=8.00"

Area (ac)	CN	Description
1.700	92	Gravel
0.130	61	>75% Grass cover, Good, HSG B
0.010	80	>75% Grass cover, Good, HSG D
1.840	90	Weighted Average
1.840		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 4:

Runoff = 4.50 cfs @ 11.97 hrs, Volume= 0.210 af, Depth> 5.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 yr Rainfall=8.00"

Area (ac)	CN	Description
0.270	61	>75% Grass cover, Good, HSG B
0.200	98	Paved parking & roofs
0.030	98	Offsite Paved
0.500	78	Weighted Average
0.270		Pervious Area
0.230		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Pond 1P: BioRetention

Inflow Area = 2.260 ac, Inflow Depth > 6.05" for 100 yr event
Inflow = 23.22 cfs @ 11.96 hrs, Volume= 1.139 af
Outflow = 22.90 cfs @ 11.98 hrs, Volume= 1.053 af, Atten= 1%, Lag= 1.1 min
Discarded = 0.22 cfs @ 11.98 hrs, Volume= 0.177 af
Secondary = 22.68 cfs @ 11.98 hrs, Volume= 0.875 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 20.06' @ 11.98 hrs Surf.Area= 3,806 sf Storage= 5,594 cf

Plug-Flow detention time= 43.3 min calculated for 1.049 af (92% of inflow)
Center-of-Mass det. time= 15.8 min (765.4 - 749.6)

Volume	Invert	Avail.Storage	Storage Description
#1	15.75'	9,968 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
15.75	1,886	40.0	0	0
16.00	1,886	40.0	189	189
17.00	1,886	40.0	754	943
18.00	1,886	40.0	754	1,697
18.90	1,886	40.0	679	2,376
19.00	1,886	100.0	189	2,565
20.00	3,685	100.0	2,786	5,350
21.00	5,550	100.0	4,618	9,968

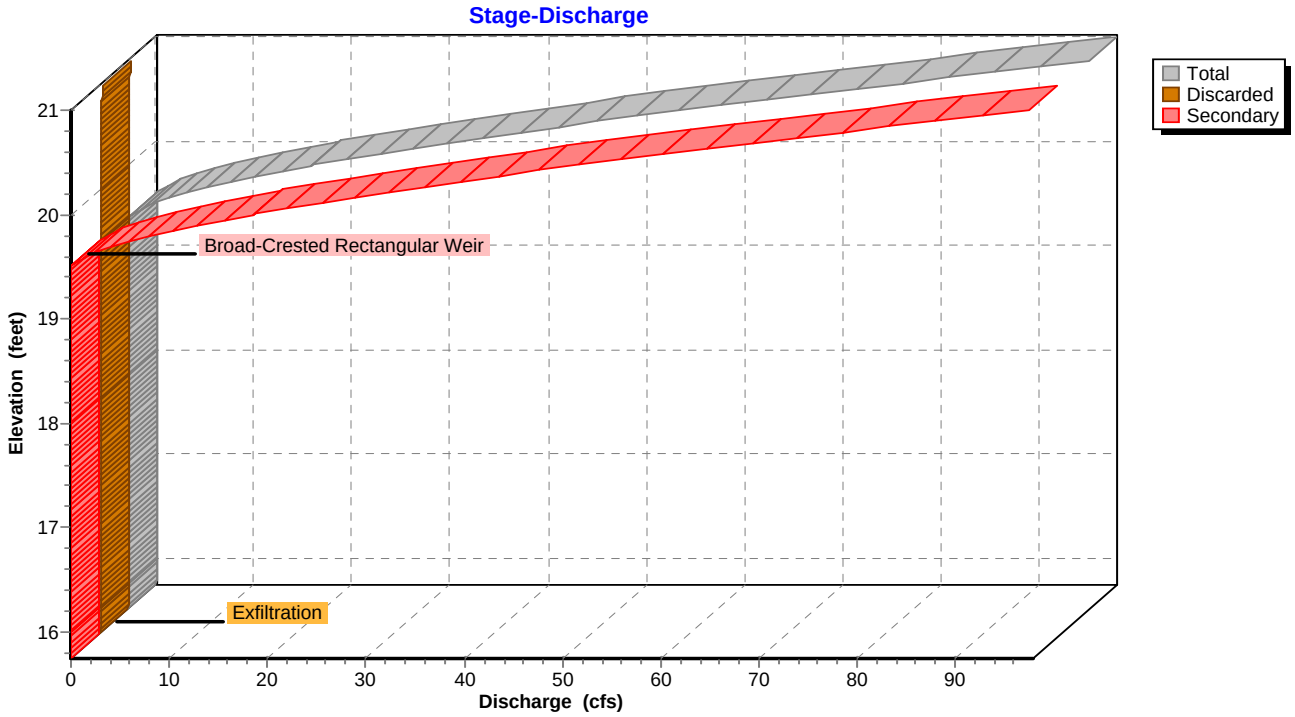
Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.500 in/hr Exfiltration over Surface area**
#2	Secondary	19.50'	**20.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=0.22 cfs @ 11.98 hrs HW=20.05' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.22 cfs)

Secondary OutFlow Max=21.88 cfs @ 11.98 hrs HW=20.05' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 21.88 cfs @ 1.98 fps)

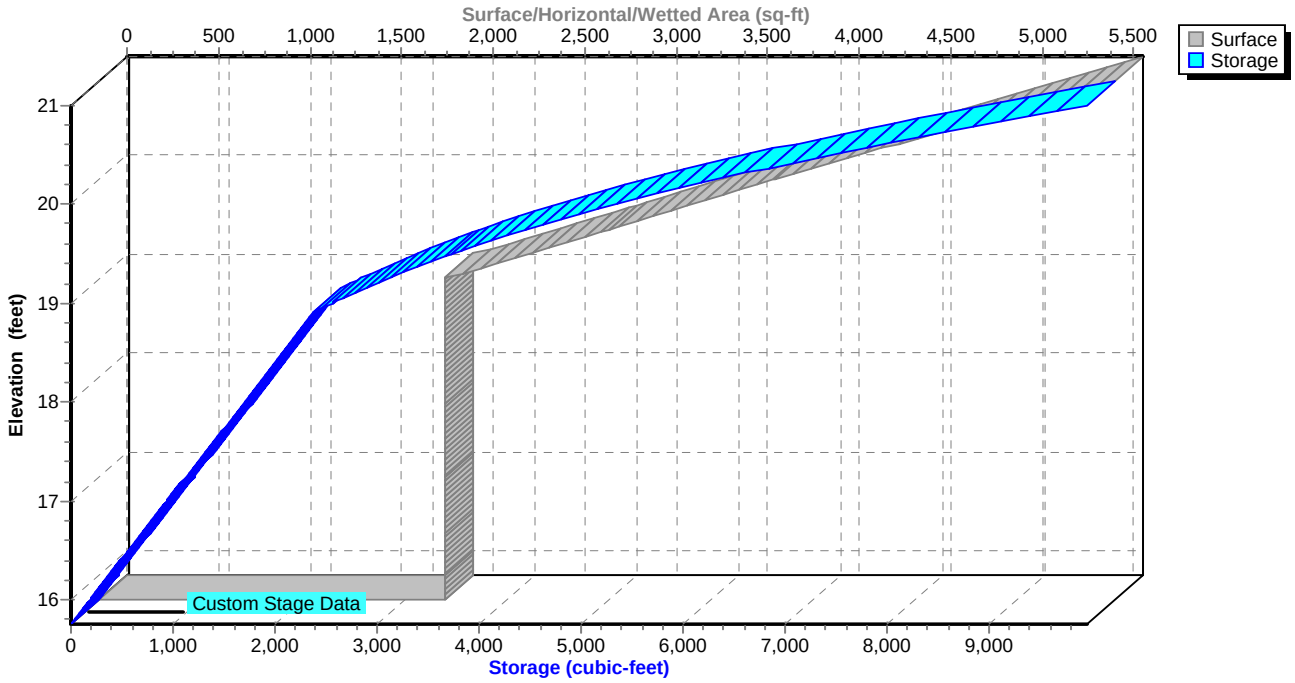
Pond 1P: BioRetention

Stage-Discharge



Pond 1P: BioRetention

Stage-Area-Storage



Pond 2P: BioRetention

Inflow Area = 3.500 ac, Inflow Depth > 6.26" for 100 yr event
Inflow = 36.74 cfs @ 11.96 hrs, Volume= 1.827 af
Outflow = 36.08 cfs @ 11.98 hrs, Volume= 1.677 af, Atten= 2%, Lag= 1.2 min
Discarded = 0.44 cfs @ 11.98 hrs, Volume= 0.337 af
Secondary = 35.64 cfs @ 11.98 hrs, Volume= 1.340 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 16.98' @ 11.98 hrs Surf.Area= 7,605 sf Storage= 9,664 cf

Plug-Flow detention time= 46.9 min calculated for 1.671 af (91% of inflow)
Center-of-Mass det. time= 17.4 min (763.0 - 745.6)

Volume	Invert	Avail.Storage	Storage Description
#1	12.75'	18,964 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
12.75	3,200	40.0	0	0
13.00	3,200	40.0	320	320
14.00	3,200	40.0	1,280	1,600
15.00	3,200	40.0	1,280	2,880
15.90	3,200	40.0	1,152	4,032
16.00	3,200	100.0	320	4,352
17.00	7,680	100.0	5,440	9,792
18.00	10,664	100.0	9,172	18,964

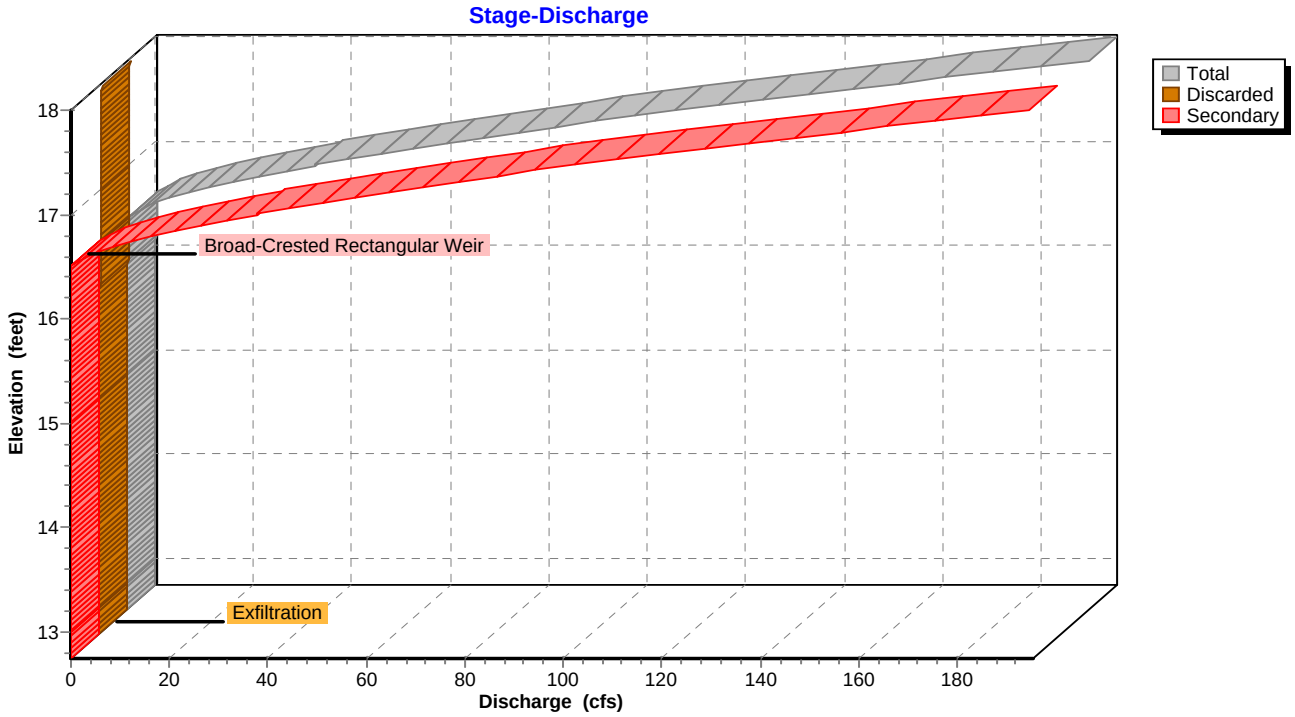
Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.500 in/hr Exfiltration over Surface area**
#2	Secondary	16.50'	**40.0' long x 12.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Discarded OutFlow Max=0.44 cfs @ 11.98 hrs HW=16.97' (Free Discharge)
↑└**1=Exfiltration** (Exfiltration Controls 0.44 cfs)

Secondary OutFlow Max=34.41 cfs @ 11.98 hrs HW=16.97' (Free Discharge)
↑└**2=Broad-Crested Rectangular Weir** (Weir Controls 34.41 cfs @ 1.82 fps)

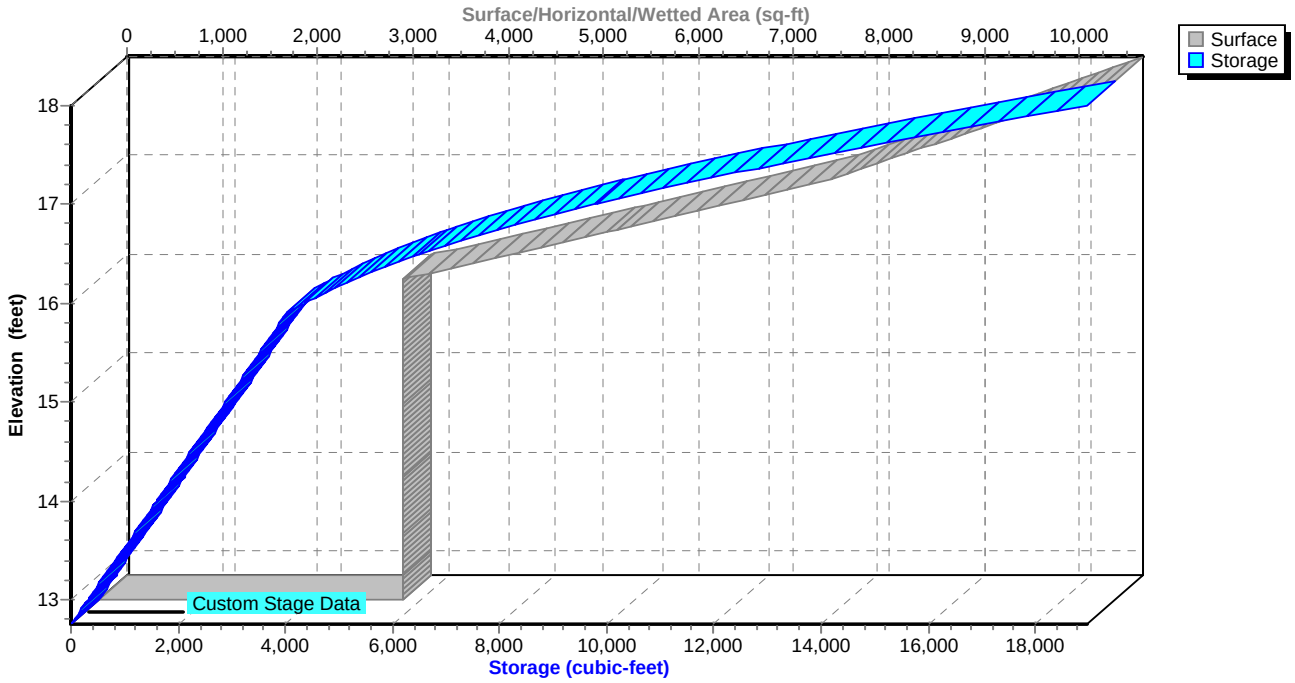
Pond 2P: BioRetention

Stage-Discharge



Pond 2P: BioRetention

Stage-Area-Storage



Pond 3P: BioRetention

Inflow Area = 1.840 ac, Inflow Depth > 6.37" for 100 yr event
Inflow = 19.50 cfs @ 11.96 hrs, Volume= 0.977 af
Outflow = 19.36 cfs @ 11.98 hrs, Volume= 0.890 af, Atten= 1%, Lag= 0.9 min
Primary = 0.22 cfs @ 11.98 hrs, Volume= 0.183 af
Secondary = 19.14 cfs @ 11.98 hrs, Volume= 0.707 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 16.89' @ 11.98 hrs Surf.Area= 3,299 sf Storage= 4,905 cf

Plug-Flow detention time= 49.6 min calculated for 0.887 af (91% of inflow)
Center-of-Mass det. time= 18.1 min (761.7 - 743.6)

Volume	Invert	Avail.Storage	Storage Description
#1	12.25'	9,506 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
12.25	1,720	40.0	0	0
13.00	1,720	40.0	516	516
14.00	1,720	40.0	688	1,204
15.00	1,720	40.0	688	1,892
15.90	1,720	40.0	619	2,511
16.00	1,720	100.0	172	2,683
17.00	3,503	100.0	2,612	5,295
18.00	4,920	100.0	4,212	9,506

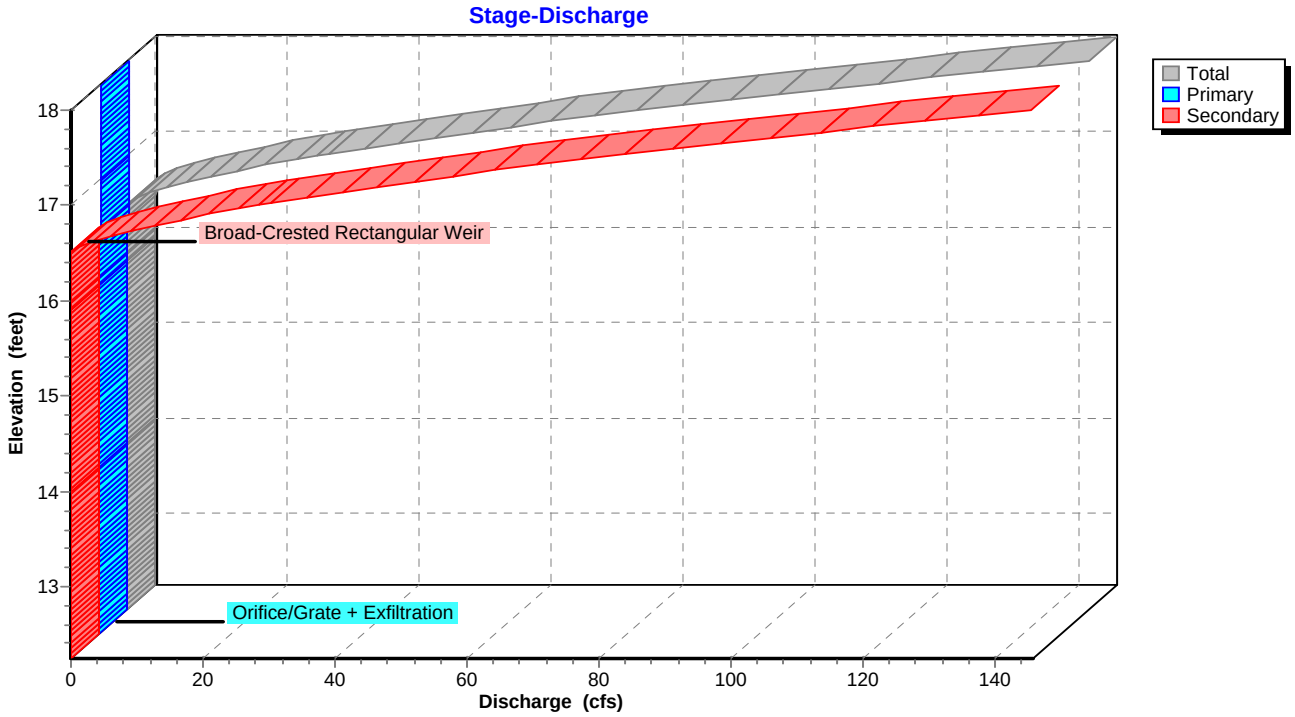
Device	Routing	Invert	Outlet Devices
#1	Primary	12.25'	**4.0" Vert. Orifice/Grate** C= 0.600
#2	Device 1	0.00'	**2.830 in/hr Exfiltration over Surface area**
#3	Secondary	16.50'	**30.0' long x 14.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.64 2.67 2.70 2.65 2.64 2.65 2.65 2.63

Primary OutFlow Max=0.21 cfs @ 11.98 hrs HW=16.88' (Free Discharge)
└**1=Orifice/Grate** (Passes 0.21 cfs of 0.89 cfs potential flow)
└**2=Exfiltration** (Exfiltration Controls 0.21 cfs)

Secondary OutFlow Max=18.38 cfs @ 11.98 hrs HW=16.88' (Free Discharge)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 18.38 cfs @ 1.63 fps)

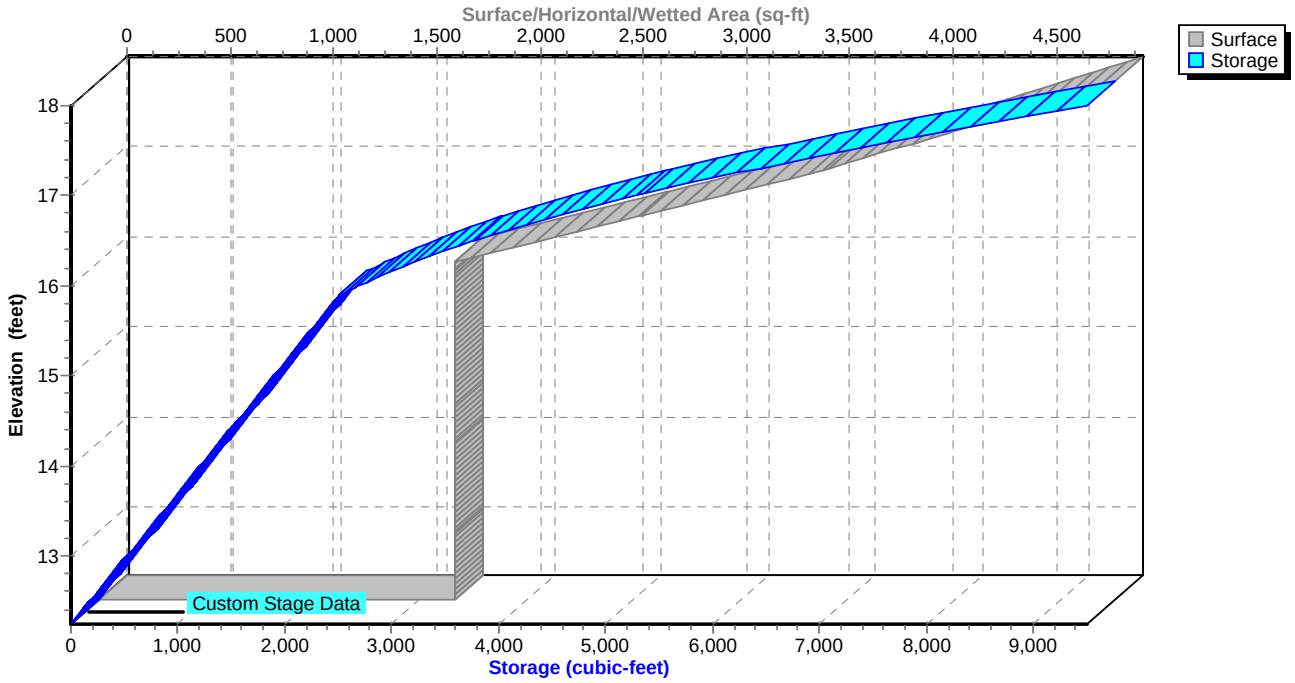
Pond 3P: BioRetention

Stage-Discharge



Pond 3P: BioRetention

Stage-Area-Storage



Link 1X: Delaware River

Inflow Area = 43.970 ac, Inflow Depth > 4.06" for 100 yr event
Inflow = 201.80 cfs @ 12.02 hrs, Volume= 14.873 af
Primary = 201.80 cfs @ 12.02 hrs, Volume= 14.873 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 2X: DP&L

Inflow Area = 11.100 ac, Inflow Depth > 4.08" for 100 yr event
Inflow = 69.99 cfs @ 12.03 hrs, Volume= 3.772 af
Primary = 69.99 cfs @ 12.03 hrs, Volume= 3.772 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 3X: DP&L

Inflow Area = 6.630 ac, Inflow Depth > 4.35" for 100 yr event
Inflow = 45.04 cfs @ 12.03 hrs, Volume= 2.401 af
Primary = 45.04 cfs @ 12.03 hrs, Volume= 2.401 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 4X: GETTY

Inflow Area = 0.500 ac, Inflow Depth > 5.03" for 100 yr event
Inflow = 4.50 cfs @ 11.97 hrs, Volume= 0.210 af
Primary = 4.50 cfs @ 11.97 hrs, Volume= 0.210 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Subcatchment 1:

Runoff = 1.75 cfs @ 12.31 hrs, Volume= 0.292 af, Depth> 0.14"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr WQ Rainfall=2.00"

Area (ac)	CN	Description
0.180	98	Paved parking & roofs
5.430	61	>75% Grass cover, Good, HSG B
4.100	72	Small grain, SR + CR, Good, HSG B
6.700	55	Woods, Good, HSG B
5.830	77	Woods, Good, HSG D
0.790	80	>75% Grass cover, Good, HSG D
1.590	72	Offsite Small Grain B
0.150	98	Offsite Paved
24.770	67	Weighted Average
24.440		Pervious Area
0.330		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	100	0.0200	0.35		**Sheet Flow, 1-A** Cultivated: Residue<=20% n= 0.060 P2= 3.20"
3.4	245	0.0180	1.21		**Shallow Concentrated Flow, 1-B** Cultivated Straight Rows Kv= 9.0 fps
2.9	315	0.0400	1.80		**Shallow Concentrated Flow, 1-C** Cultivated Straight Rows Kv= 9.0 fps
5.1	1,430	0.0030	4.66	14.64	**Circular Channel (pipe), 1-D** Diam= 24.0" Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.011
8.2	205	0.0070	0.42		**Shallow Concentrated Flow, 1-E** Woodland Kv= 5.0 fps
1.1	85	0.0070	1.25		**Shallow Concentrated Flow, 1-F** Grassed Waterway Kv= 15.0 fps
25.4	2,380	Total			

Subcatchment 1A:

Runoff = 3.53 cfs @ 11.97 hrs, Volume= 0.156 af, Depth> 0.83"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr WQ Rainfall=2.00"

Area (ac)	CN	Description
1.480	92	Gravel
0.410	61	>75% Grass cover, Good, HSG B
0.370	98	Paved parking & roofs
2.260	87	Weighted Average
1.890		Pervious Area
0.370		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 2:

Runoff = 0.38 cfs @ 12.11 hrs, Volume= 0.047 af, Depth> 0.13"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr WQ Rainfall=2.00"

Area (ac)	CN	Description
1.860	58	Woods/grass comb., Good, HSG B
2.610	72	Small grain, SR + CR, Good, HSG B
4.470	66	Weighted Average
4.470		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	80	0.0300	0.40		**Sheet Flow, 2-A** Cultivated: Residue<=20% n= 0.060 P2= 3.20"
5.9	230	0.0170	0.65		**Shallow Concentrated Flow, 2-B** Woodland Kv= 5.0 fps
3.2	205	0.0450	1.06		**Shallow Concentrated Flow, 2-C** Woodland Kv= 5.0 fps
12.4	515	Total			

Subcatchment 2A:

Runoff = 6.19 cfs @ 11.97 hrs, Volume= 0.276 af, Depth> 0.95"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr WQ Rainfall=2.00"

Area (ac)	CN	Description
3.120	92	Gravel
0.380	61	>75% Grass cover, Good, HSG B
3.500	89	Weighted Average
3.500		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 3:

Runoff = 2.12 cfs @ 12.06 hrs, Volume= 0.139 af, Depth> 0.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr WQ Rainfall=2.00"

Area (ac)	CN	Description
6.630	72	Small grain, SR + CR, Good, HSG B
6.630		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.2	100	0.0100	0.27		**Sheet Flow, 3-A** Cultivated: Residue<=20% n= 0.060 P2= 3.20"
0.9	60	0.0160	1.14		**Shallow Concentrated Flow, 3-B** Cultivated Straight Rows Kv= 9.0 fps
4.1	315	0.0200	1.27		**Shallow Concentrated Flow, 3-C** Cultivated Straight Rows Kv= 9.0 fps
11.2	475	Total			

Subcatchment 3A:

Runoff = 3.45 cfs @ 11.97 hrs, Volume= 0.155 af, Depth> 1.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr WQ Rainfall=2.00"

Area (ac)	CN	Description
1.700	92	Gravel
0.130	61	>75% Grass cover, Good, HSG B
0.010	80	>75% Grass cover, Good, HSG D
1.840	90	Weighted Average
1.840		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 4:

Runoff = 0.40 cfs @ 11.99 hrs, Volume= 0.018 af, Depth> 0.43"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr WQ Rainfall=2.00"

Area (ac)	CN	Description
0.270	61	>75% Grass cover, Good, HSG B
0.200	98	Paved parking & roofs
0.030	98	Offsite Paved
0.500	78	Weighted Average
0.270		Pervious Area
0.230		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Pond 1P: BioRetention

Inflow Area = 2.260 ac, Inflow Depth > 0.83" for WQ event
Inflow = 3.53 cfs @ 11.97 hrs, Volume= 0.156 af
Outflow = 0.16 cfs @ 13.53 hrs, Volume= 0.101 af, Atten= 96%, Lag= 93.3 min
Discarded = 0.16 cfs @ 13.53 hrs, Volume= 0.101 af
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 19.47' @ 13.53 hrs Surf.Area= 2,738 sf Storage= 3,659 cf

Plug-Flow detention time= 201.6 min calculated for 0.101 af (65% of inflow)
Center-of-Mass det. time= 126.1 min (919.2 - 793.1)

Volume	Invert	Avail.Storage	Storage Description
#1	15.75'	9,968 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
15.75	1,886	40.0	0	0
16.00	1,886	40.0	189	189
17.00	1,886	40.0	754	943
18.00	1,886	40.0	754	1,697
18.90	1,886	40.0	679	2,376
19.00	1,886	100.0	189	2,565
20.00	3,685	100.0	2,786	5,350
21.00	5,550	100.0	4,618	9,968

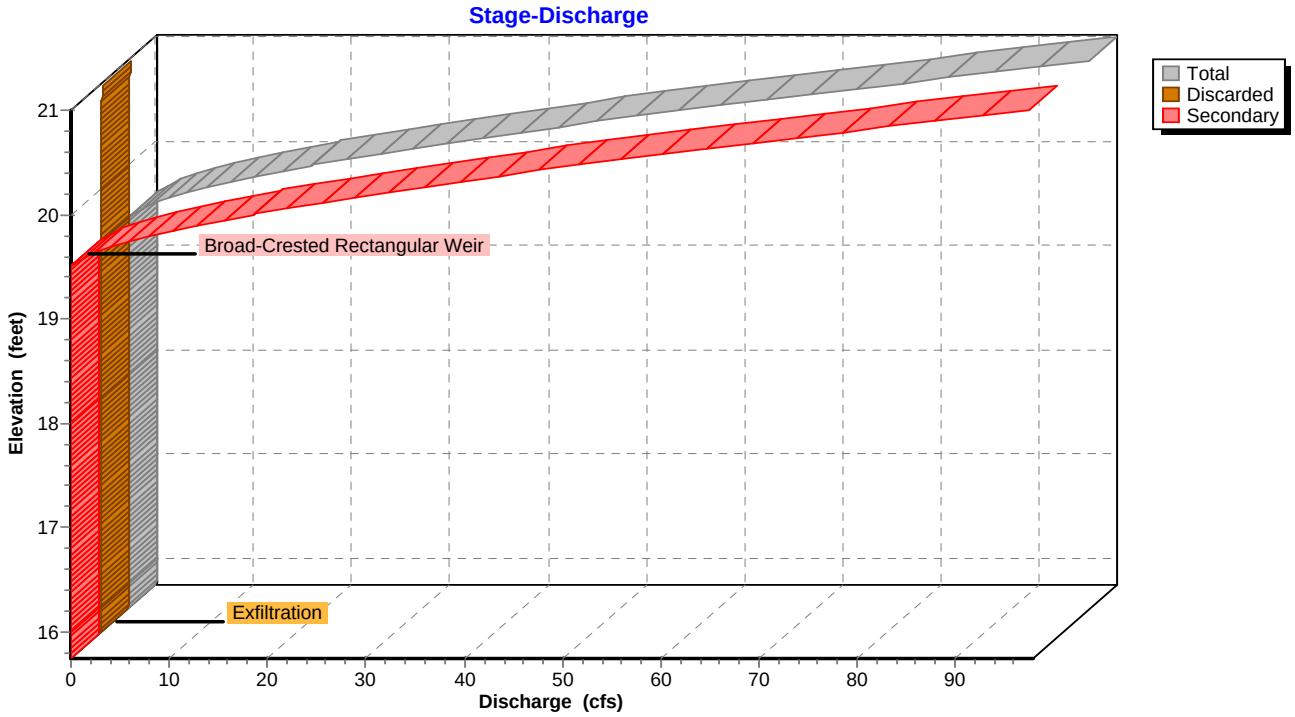
Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.500 in/hr Exfiltration over Surface area**
#2	Secondary	19.50'	**20.0' long x 10.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=0.16 cfs @ 13.53 hrs HW=19.47' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.16 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=15.75' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

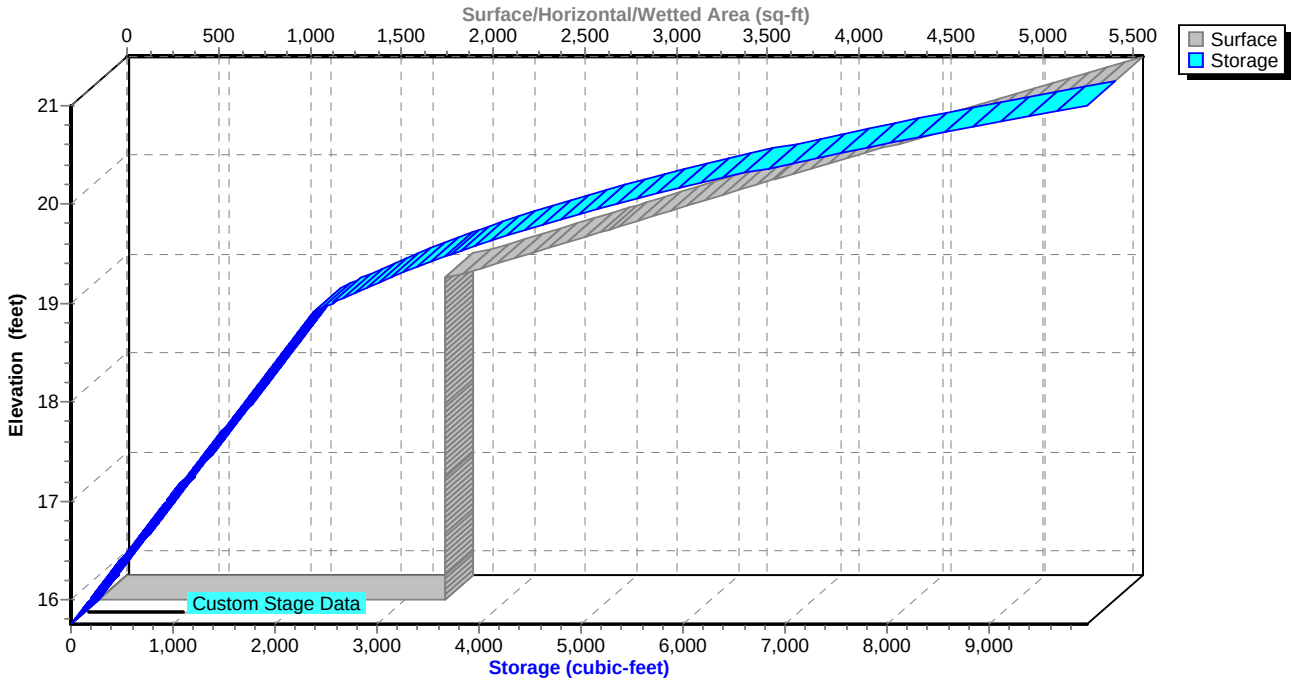
Pond 1P: BioRetention

Stage-Discharge



Pond 1P: BioRetention

Stage-Area-Storage



Pond 2P: BioRetention

Inflow Area = 3.500 ac, Inflow Depth > 0.95" for WQ event
Inflow = 6.19 cfs @ 11.97 hrs, Volume= 0.276 af
Outflow = 0.31 cfs @ 13.24 hrs, Volume= 0.187 af, Atten= 95%, Lag= 76.1 min
Discarded = 0.31 cfs @ 13.24 hrs, Volume= 0.187 af
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 16.47' @ 13.24 hrs Surf.Area= 5,307 sf Storage= 6,353 cf

Plug-Flow detention time= 190.5 min calculated for 0.187 af (68% of inflow)
Center-of-Mass det. time= 119.3 min (905.6 - 786.3)

Volume	Invert	Avail.Storage	Storage Description
#1	12.75'	18,964 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
12.75	3,200	40.0	0	0
13.00	3,200	40.0	320	320
14.00	3,200	40.0	1,280	1,600
15.00	3,200	40.0	1,280	2,880
15.90	3,200	40.0	1,152	4,032
16.00	3,200	100.0	320	4,352
17.00	7,680	100.0	5,440	9,792
18.00	10,664	100.0	9,172	18,964

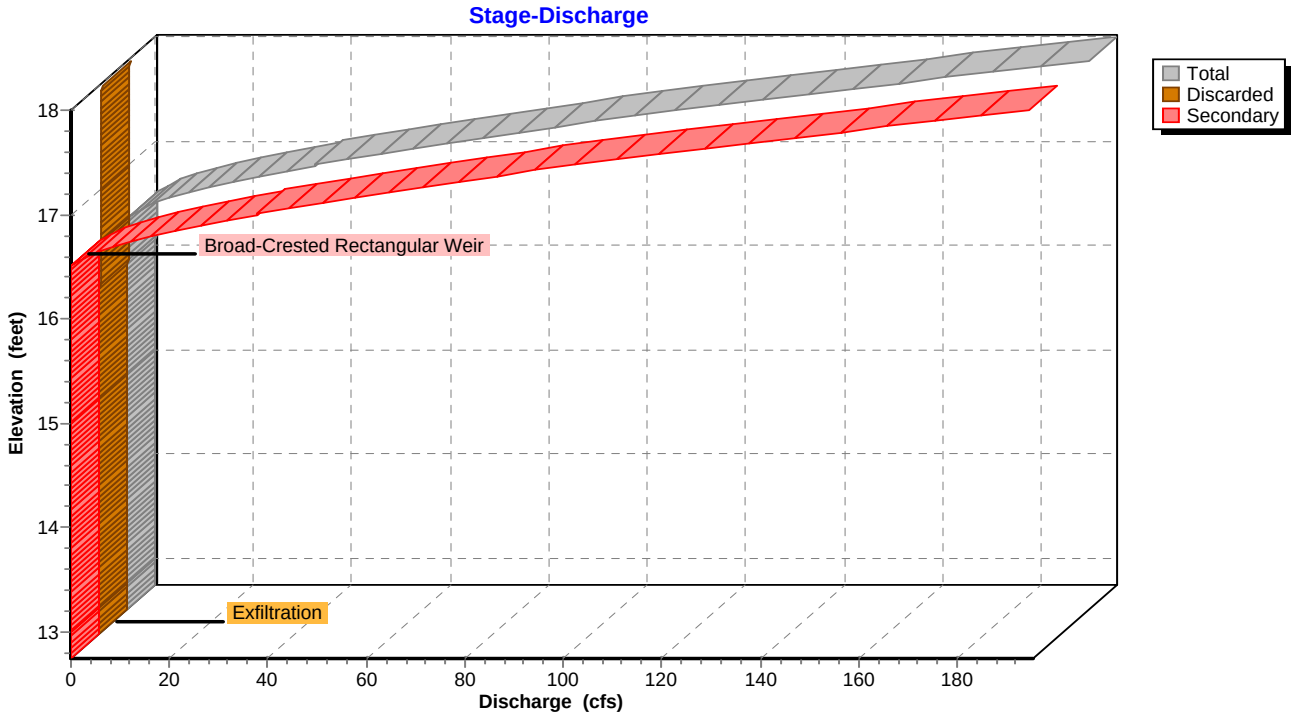
Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**2.500 in/hr Exfiltration over Surface area**
#2	Secondary	16.50'	**40.0' long x 12.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Discarded OutFlow Max=0.31 cfs @ 13.24 hrs HW=16.47' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.31 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=12.75' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

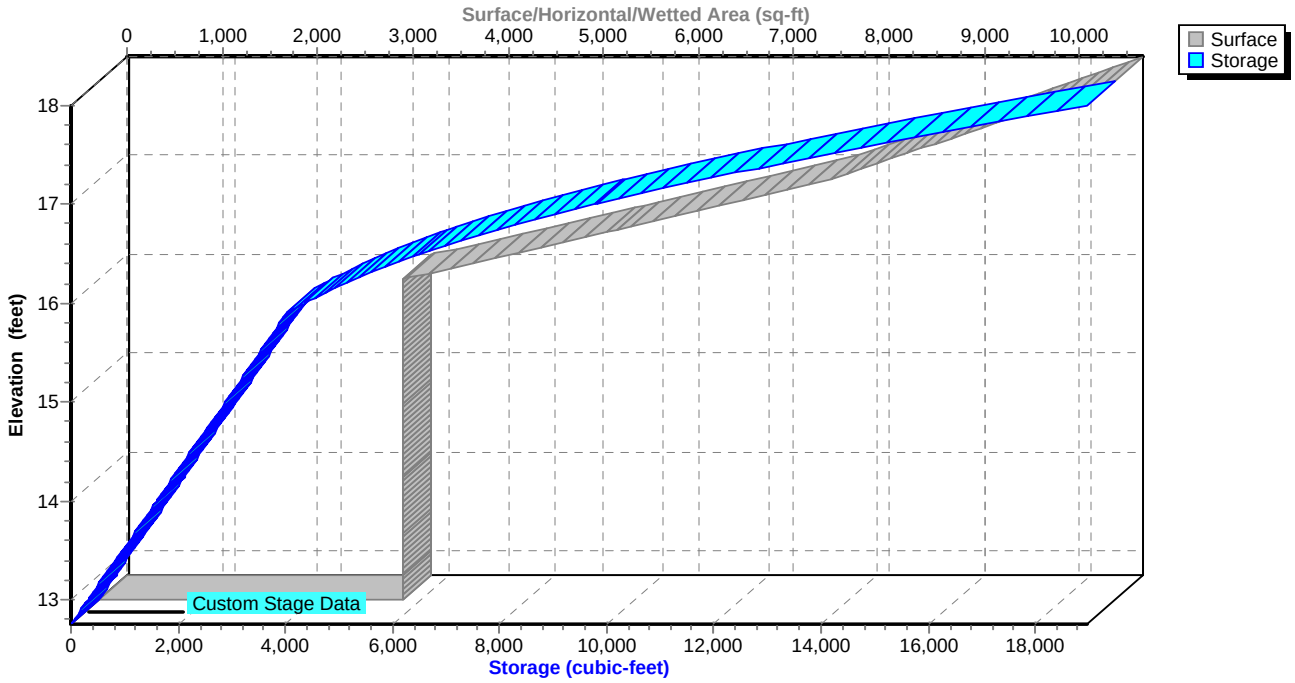
Pond 2P: BioRetention

Stage-Discharge



Pond 2P: BioRetention

Stage-Area-Storage



Pond 3P: BioRetention

Inflow Area = 1.840 ac, Inflow Depth > 1.01" for WQ event
Inflow = 3.45 cfs @ 11.97 hrs, Volume= 0.155 af
Outflow = 0.17 cfs @ 13.25 hrs, Volume= 0.104 af, Atten= 95%, Lag= 76.8 min
Primary = 0.17 cfs @ 13.25 hrs, Volume= 0.104 af
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 16.46' @ 13.25 hrs Surf.Area= 2,547 sf Storage= 3,673 cf

Plug-Flow detention time= 198.6 min calculated for 0.103 af (67% of inflow)
Center-of-Mass det. time= 128.5 min (911.1 - 782.6)

Volume	Invert	Avail.Storage	Storage Description
#1	12.25'	9,506 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
12.25	1,720	40.0	0	0
13.00	1,720	40.0	516	516
14.00	1,720	40.0	688	1,204
15.00	1,720	40.0	688	1,892
15.90	1,720	40.0	619	2,511
16.00	1,720	100.0	172	2,683
17.00	3,503	100.0	2,612	5,295
18.00	4,920	100.0	4,212	9,506

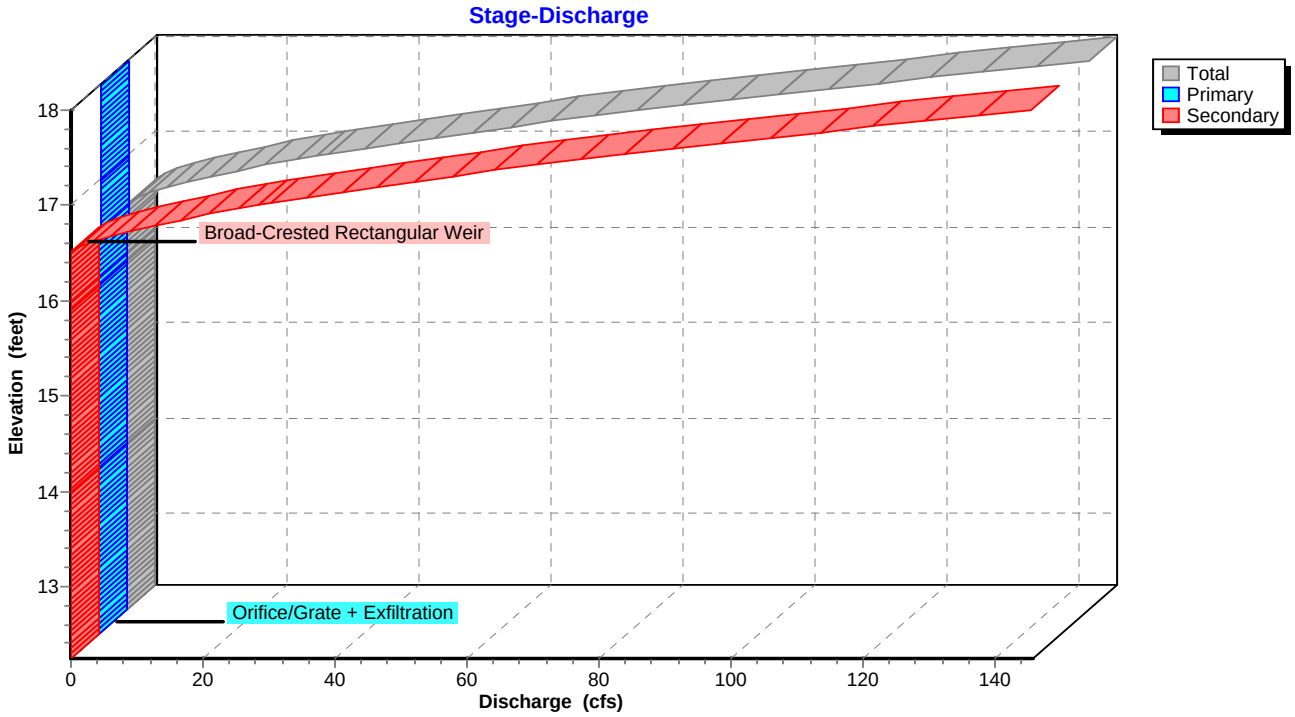
Device	Routing	Invert	Outlet Devices
#1	Primary	12.25'	**4.0" Vert. Orifice/Grate** C= 0.600
#2	Device 1	0.00'	**2.830 in/hr Exfiltration over Surface area**
#3	Secondary	16.50'	**30.0' long x 14.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.64 2.67 2.70 2.65 2.64 2.65 2.65 2.63

Primary OutFlow Max=0.17 cfs @ 13.25 hrs HW=16.46' (Free Discharge)
↑—**1=Orifice/Grate** (Passes 0.17 cfs of 0.85 cfs potential flow)
↑—**2=Exfiltration** (Exfiltration Controls 0.17 cfs)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=12.25' (Free Discharge)
↑—**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

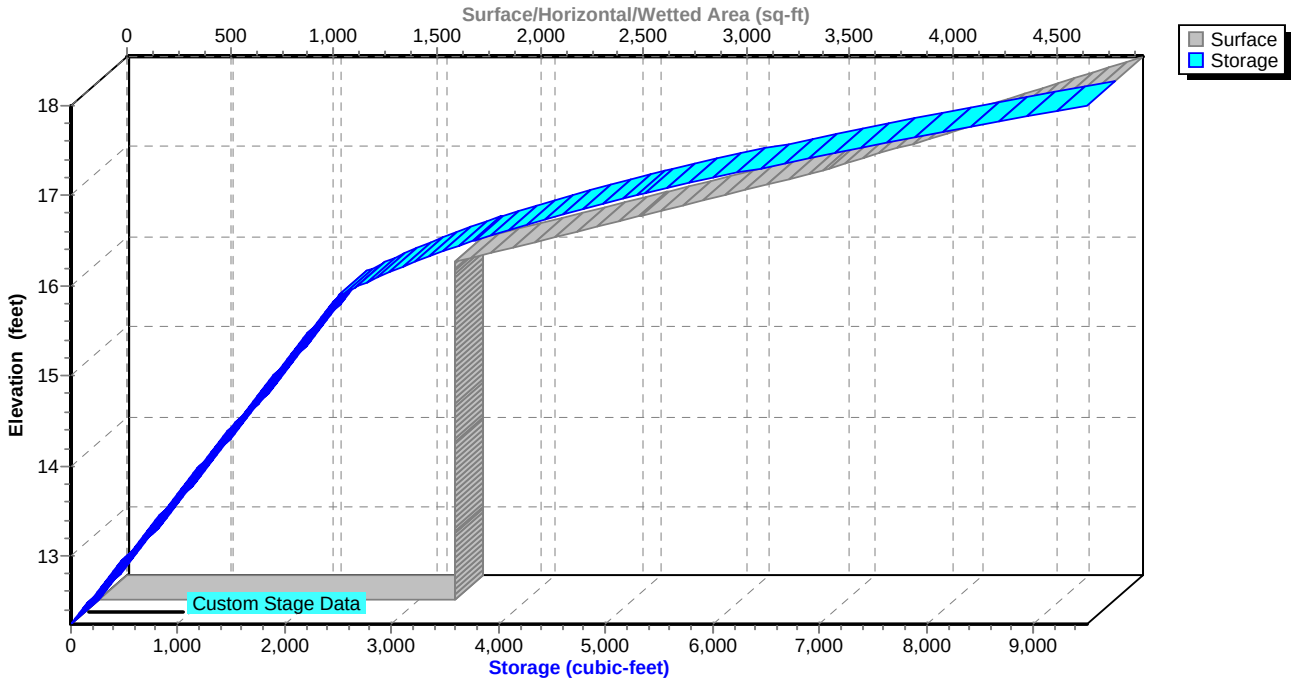
Pond 3P: BioRetention

Stage-Discharge



Pond 3P: BioRetention

Stage-Area-Storage



Link 1X: Delaware River

Inflow Area = 43.970 ac, Inflow Depth > 0.16" for WQ event
Inflow = 3.30 cfs @ 12.10 hrs, Volume= 0.600 af
Primary = 3.30 cfs @ 12.10 hrs, Volume= 0.600 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 2X: DP&L

Inflow Area = 11.100 ac, Inflow Depth > 0.20" for WQ event
Inflow = 2.44 cfs @ 12.07 hrs, Volume= 0.186 af
Primary = 2.44 cfs @ 12.07 hrs, Volume= 0.186 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 3X: DP&L

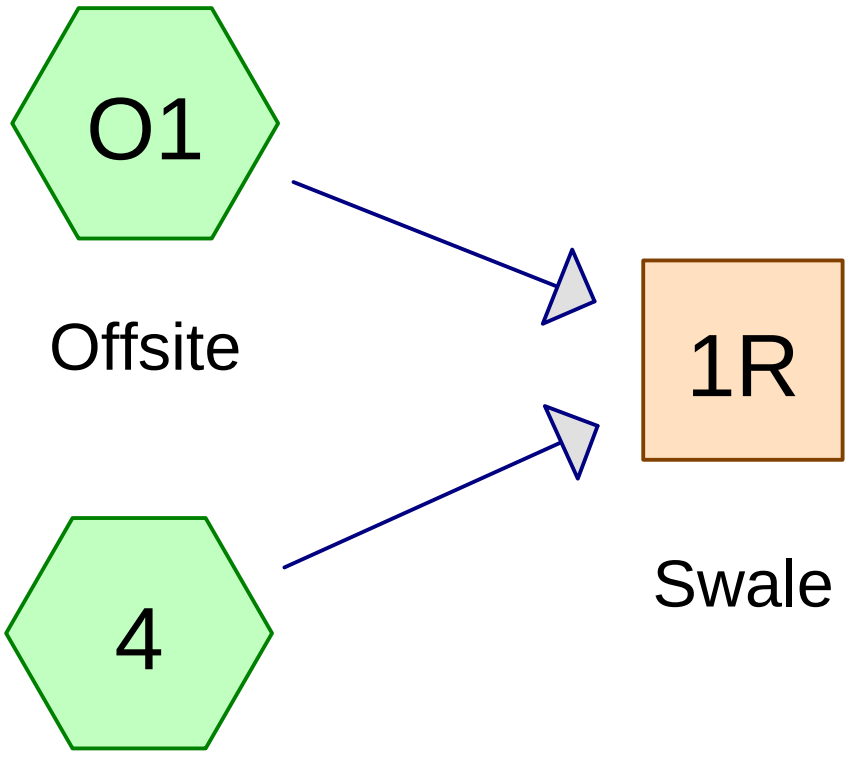
Inflow Area = 6.630 ac, Inflow Depth > 0.25" for WQ event
Inflow = 2.12 cfs @ 12.06 hrs, Volume= 0.139 af
Primary = 2.12 cfs @ 12.06 hrs, Volume= 0.139 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Link 4X: GETTY

Inflow Area = 0.500 ac, Inflow Depth > 0.43" for WQ event
Inflow = 0.40 cfs @ 11.99 hrs, Volume= 0.018 af
Primary = 0.40 cfs @ 11.99 hrs, Volume= 0.018 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs



Subcat Reach Pond Link

Drainage Diagram for DSGP 1593 River Rd-Swale
Prepared by McBride & Ziegler, Inc. 10/25/2011

Subcatchment 4:

Runoff = 4.50 cfs @ 11.97 hrs, Volume= 0.210 af, Depth> 5.03"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 yr Rainfall=8.00"

Area (ac)	CN	Description
0.270	61	>75% Grass cover, Good, HSG B
0.200	98	Paved parking & roofs
0.030	98	Offsite Paved
0.500	78	Weighted Average
0.270		Pervious Area
0.230		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment O1: Offsite

Runoff = 87.38 cfs @ 12.06 hrs, Volume= 5.101 af, Depth> 4.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 yr Rainfall=8.00"

Area (ac)	CN	Description
13.100	72	Small grain, SR + CR, Good, HSG B
0.300	98	Paved parking & roofs
0.700	55	Woods, Good, HSG B
14.100	72	Weighted Average
13.800		Pervious Area
0.300		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	100	0.0400	0.47		**Sheet Flow, O1-A** Cultivated: Residue<=20% n= 0.060 P2= 3.20"
3.6	390	0.0400	1.80		**Shallow Concentrated Flow, O1-B** Cultivated Straight Rows Kv= 9.0 fps
4.5	420	0.0300	1.56		**Shallow Concentrated Flow, O1-C** Cultivated Straight Rows Kv= 9.0 fps
2.4	220	0.0300	1.56		**Shallow Concentrated Flow, O1-D** Cultivated Straight Rows Kv= 9.0 fps
14.1	1,130	Total			

Reach 1R: Swale

Inflow Area = 14.600 ac, Inflow Depth > 4.36" for 100 yr event
Inflow = 89.84 cfs @ 12.06 hrs, Volume= 5.311 af
Outflow = 87.32 cfs @ 12.09 hrs, Volume= 5.300 af, Atten= 3%, Lag= 2.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.82 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 1.66 fps, Avg. Travel Time= 3.9 min

Peak Storage= 5,878 cf @ 12.07 hrs, Average Depth at Peak Storage= 1.29'
Bank-Full Depth= 3.00', Capacity at Bank-Full= 472.46 cfs

8.00' x 3.00' deep channel, n= 0.025 Short grass
Side Slope Z-value= 3.0 '/' Top Width= 26.00'
Length= 385.0' Slope= 0.0104 '/'
Inlet Invert= 24.00', Outlet Invert= 20.00'

‡

DURMM ANALYSIS POST-DEVELOPMENT SUBAREA

PROJECT:	DIAMOND STATE 1593 RIVER ROAD			PREPARED BY	
MUNICIPALITY:		COUNTY:	NEW CASTLE	McBride & Ziegler, Inc.	
SUBAREA:	ENTRANCE	HYDROGRAPH	SCS	DATE:	
BMP:	FILTER STRIP #1			July 11, 2011	

DURMM INPUT DATA :

GRADED PERVIOUS	CODE	HSG	AREA	AREA(ac)	IMPERVIOUS		LENGTH/AR.	WIDTH/ NO.	AREA(ac)
LAWNS-GD	11	b	3,750	0.09	RES.STREET	24	745	22	0.38
CN & ACRES OF GRADED PERVIOUS			61.0	0.09	CN & ACRES OF IMPERVIOUS			97.1	0.38

NATURAL PERVIOUS	CODE	HSG	AREA	AREA(ac)	TOTAL ACREAGE	0.46	% IMPERV.	81%
					DISCONNECTION ADJUSTMENTS			
					PERCENT IMPERVIOUS		WETTED AREAS	
					WETTED LENGTH		IN SOURCE	
					WETTED WIDTH		IN BMPs	0.09
					% FLOW PATH		TOTAL	0.09
CN & ACRES OF NATURAL PERVIOUS					PERVIOUS CN		%IMPERV.	23%

EVENT	PRECIP.	NATURAL	GRADED	IMPERV.	TO BMPs	FROM BMPs	REDUCTION	RUNOFF(in.)
QUALITY	2.0		62	2,298	2,359		100%	
BANKFULL	3.3		184	4,069	4,253		100%	
CONVEYANCE	5.2		466	6,638	7,104	2,061	71%	1.04
FLOODING	7.3		913	9,493	10,405	5,910	43%	2.97

FLOW PATHS	SHEET FLOW PARAMETERS			SWALE FLOW PARAMETERS					
	LENGTH	SLOPE	Manning's n	SURFACE	FLOW %	LENGTH	SLOPE	SIDES	BOTTOM
UPPER	48	0.0200	0.011	4	50%	2	0.0200	4.0	6.0
LOWER				4	100%	5	0.0200	4.0	8.0
% RUNOFF IMPERV.	97%	Tc Path	IMPERV	4		600	0.0100	6.0	12.0

ROUTING RESULTS:		OK	SHEET TIME (hr.)	DEPTH (ft.)	VELOCITY (fps.)	SWALE TIME (hr.)	TOTAL TIME (min.)	PEAK FLOW (cfs)	CURVE NO
QUALITY	STORAGE	10.00	0.014	0.01	0.22	0.00	1.4	0.01	50.0
	Ia/P	1.000		0.01	0.22	0.01			
	BIOSWALE RESULTS			0.00	0.11	1.57	95.4		-100%
BANKFULL	STORAGE	16.50	0.011	0.01	0.22	0.00	1.2	0.01	37.7
	Ia/P	1.000		0.01	0.22	0.01			
	BIOSWALE RESULTS			0.00	0.11	1.57	95.2		-100%
CONVEYANCE	STORAGE	8.42	0.009	0.22	0.28	0.00	0.9	1.26	54.3
	Ia/P	0.324		0.27	0.31	0.00			
	BIOSWALE RESULTS			0.00	0.11	1.57	95.0	0.16	-88%
FLOODING	STORAGE	6.26	0.007	0.32	0.40	0.00	0.7	3.05	61.5
	Ia/P	0.172		0.35	0.55	0.00			
	BIOSWALE RESULTS			0.00	0.11	1.57	94.7	0.55	-82%

SUBAREA POLLUTANT LOADING

PARAMETER	*TSS*	*PP*	*SP*	*ON*	*NH3*	*NO3*	*Cu*	*Zn*
IMPERVIOUS EMCs (mg/l)	110	0.30	0.10	1.15	0.15	0.55	0.025	0.140
GRADED PERVIOUS EMCs (mg/l)	100	0.65	0.60	1.80	0.50	0.35	0.015	0.090
NATURAL PERVIOUS EMCs (mg/l)								
IMPERVIOUS LOADS (g.)	7,158	19.5	6.5	74.8	9.8	35.8	1.6	9.1
GRADED PERVIOUS LOADS (g.)	175	1.1	1.0	3.1	0.9	0.6	0.0	0.2
NATURAL PERVIOUS LOADS (g.)								
TOTAL SUBAREA LOAD	7,333	21	8	78	11	36	1.7	9.3

DURMM ANALYSIS BMP DESIGN DATA & RESULTS

PROJECT:	DIAMOND STATE 1593 RIVER ROAD			PREPARED BY
MUNICIPALITY:		COUNTY:	NEW CASTLE	McBride & Ziegler, Inc.
SUBAREA:	ENTRANCE	HYDROGRAPH	SCS	DATE:
BMP:	FILTER STRIP #1			July 11, 2011

POSTDEVELOPMENT LOAD DATA

PARAMETER	TSS	PP	SP	ON	NH3	NO3	Cu	Zn
INPUT CONCENTRATION	109.7	0.31	0.11	1.17	0.16	0.54	0.025	0.139
INPUT MASS LOADS (g)	7,333	21	8	78	11	36	2	9
INCREASE IN SUBAREA LOAD	(179,817)	(46)	(38)	(539)	(157)	(162)	(0)	(3)
% PREDEVELOPMENT LOAD	4%	31%	17%	13%	6%	18%	86%	78%

BMP DESIGN AND PERFORMANCE

BIO. OK? OK | AREA OK? ######### | LOAD OK? OK

FILTER STRIPS	CN	61	LENGTH	745	WIDTH	5	SLOPE	2%	COVER #	1.00
	INPUT LOAD		7,333	20.7	7.6	78.0	10.6	36.4	1.65	9.27
	OUTPUT CONC .		25.0	0.19	0.11	0.73	0.13	0.46	0.009	0.031
% FLOW	OUTPUT LOAD		952	7.3	4.1	27.9	5.1	17.5	0.34	1.18
100.0%	PERCENT REMOVAL		87%	65%	46%	64%	52%	52%	80%	87%
3725	LINEAR LOAD (cu.ft./ft.)		3.08	TO BMP	2359	FROM BMP	1342	RUNOFF REDUCTION		43%

BIO-RETENTION	BUFFER		LENGTH		WIDTH		DEPTH		INF. RATE	
	INPUT LOAD									
	OUTPUT CONC .									
% FLOW	OUTPUT LOAD									
	PERCENT REMOVAL									
	HYDRAULIC LOAD (ft.)			TO BMP		FROM BMP		RUNOFF REDUCTION		

BIOSWALE QUALITY DESIGN	CN	55	LENGTH	600	SIDES:1	6.0	BOTTOM	12.0	SWALE OK?	OK
	SLOPE	1.0%	COVER	4	DENSE GRASS		VELOCITY	0.11	DEPTH	0.00
	INPUT LOAD									
	OUTPUT CONC .									
% FLOW	OUTPUT LOAD									
	PERCENT REMOVAL									
9000	RESIDENCE TIME (min.)		94.0	TO BMP		FROM BMP		RUNOFF REDUCTION		

BIOSWALE CAPACITY, STABILITY & VOLUMES	VELOCITY	CHECK DAM DESIGN		POND EL.	AREA	VOLUME	FILTER EL.	OUTFLOW	FACE EL.	OUTFLOW
	0.00	NO. DAMS	6	0.50	4,500	750	0.20	0.23	1.20	0.44
	OK	LENGTH (ft)	2.3	1.00	10,800	4,462	0.40	0.71	1.40	1.33
	CAPACITY	WIDTH (ft.)		1.50	14,400	10,740	0.60	1.41	1.60	2.59
	DEPTH	STONE (in.)	1.50	2.00	18,000	18,824	0.80	2.33	1.80	4.21
	0.00	HEIGHT	1.00	2.50	21,600	28,710	1.00	3.49	2.00	6.20

INFILT-RATION. TRENCH	% SURFACE	100.0%	LENGTH:	300	WIDTH:	3.0	DEPTH:	3	INF. RATE	2.00
	INFILTRATED LOAD		952	7.3	4.1	27.9	5.1	17.5	0.34	1.18
	INFILTRATION TIME		23.8	TO BMP	1342	FROM BMP		RUNOFF REDUCTION		100%

SUMMARY OF FILTERING BMP PERFORMANCE

PARAMETER	TSS	PP	SP	ON	NH3	NO3	Cu	Zn
STRIP & SWALE OUTPUT LOAD (g)	952	7.3	4.1	27.9	5.1	17.5	0.34	1.18
ALL BMPs OUTPUT LOAD (g)	952	7.3	4.1	27.9	5.1	17.5	0.34	1.18
PERCENT REMOVAL	87%	65%	46%	64%	52%	52%	80%	87%

SUMMARY OF SURFACE AND INFILTRATION BMP PERFORMANCE

OUTPUT MASS LOAD (g)								
PERCENT REMOVAL	100%	100%	100%	100%	100%	100%	100%	100%
% PREDEVELOPMENT LOAD								

```
******  HYCHL  ****** (Version 6.1) ******           Date 10-25-2011
 Commands Read From File: C:\HYDRAIN\HYCHL\4559-SW1.CHL

       JOB BLOOM SWM1
       UNI 0
 ** UNITS PARAMETER = 0 (ENGLISH)
       CHL .05    23
       TRP 20 3 3
 ** LEFT SIDE SLOPE    3.0 AND RIGHT SIDE SLOPE    3.0
 ** THE BASE WIDTH OF THE TRAPEZOID (ft)   20.00
       N   .025 .025
 ** LOW  FLOW N VALUE=  .025
 ** SIDE SLOPE N VALUE=  .025
       LTM 7
       END
***************END OF COMMAND FILE************

 BLOOM SWM1
 ------------
 INPUT REVIEW
 ------------
   DESIGN PARAMETERS:
       DESIGN DISCHARGE (ft^3/s):           23.00
       CHANNEL SHAPE:                  TRAPEZOIDAL
       CHANNEL SLOPE (ft/ft):               .050
 -----------------------------------------
 HYDRAULIC CALCULATIONS USING NORMAL DEPTH
 -----------------------------------------

                          DESIGN     MAXIMUM
                          ------     -------
 FLOW (cfs)                23.00      130.54
 DEPTH (ft)                  .23         .64
 AREA (ft^2)                4.74       14.05
 WETTED PERIMETER (ft)     21.45       24.05
 HYDRAULIC RADIUS (ft)       .22         .58
 VELOCITY (ft/s)            4.86        9.29
 MANNINGS N (LOW FLOW)       .025        .025

 ------------------
 STABILITY ANALYSIS
 ------------------

                  LINING        PERMIS SHR   CALC. SHR  STAB.
CONDITION         TYPE          (lb/ft^2)    (lb/ft^2)  FACTOR   REMARKS
---------         ---------     ----------   ---------  ------   -------
LOW FLOW LINING
BOTTOM; STRAIGHT   SYNTHETIC MAT       2.00        .71      2.80   STABLE

 *** NORMAL END OF HYCHL ***
```

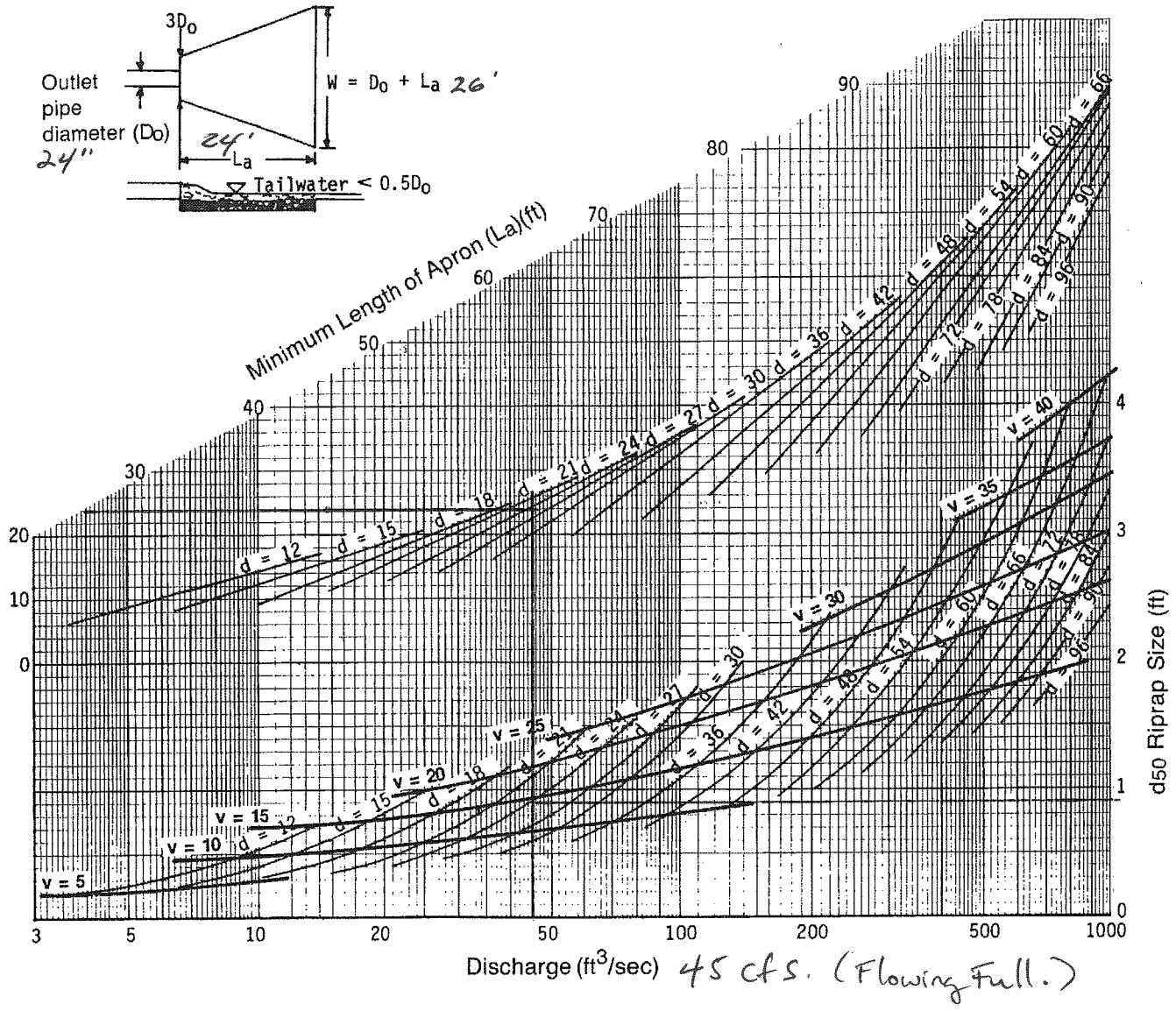
```
*****  HYCHL  ****** (Version 6.1) ******           Date 10-25-2011

 Commands Read From File: C:\HYDRAIN\HYCHL\4559-SW2.CHL

       JOB BLOOM SWM2
       UNI 0
 ** UNITS PARAMETER = 0 (ENGLISH)
       CHL .10    36
       TRP 40 3 3
 ** LEFT SIDE SLOPE    3.0 AND RIGHT SIDE SLOPE    3.0
 ** THE BASE WIDTH OF THE TRAPEZOID (ft)   40.00
       N   .03 .03
 ** LOW  FLOW N VALUE=  .030
 ** SIDE SLOPE N VALUE=  .030
       LTM 7
       END
***************END OF COMMAND FILE************

 BLOOM SWM2
 ------------
 INPUT REVIEW
 ------------
   DESIGN PARAMETERS:
       DESIGN DISCHARGE (ft^3/s):           36.00
       CHANNEL SHAPE:                  TRAPEZOIDAL
       CHANNEL SLOPE (ft/ft):               .100
 -----------------------------------------
 HYDRAULIC CALCULATIONS USING NORMAL DEPTH
 -----------------------------------------

                          DESIGN     MAXIMUM
                          ------     -------
 FLOW (cfs)                36.00       94.68
 DEPTH (ft)                  .18         .32
 AREA (ft^2)                7.29       13.13
 WETTED PERIMETER (ft)     41.14       42.03
 HYDRAULIC RADIUS (ft)       .18         .31
 VELOCITY (ft/s)            4.94        7.21
 MANNINGS N (LOW FLOW)       .030        .030

 ------------------
 STABILITY ANALYSIS
 ------------------

                  LINING       PERMIS SHR   CALC. SHR  STAB.
CONDITION         TYPE         (lb/ft^2)    (lb/ft^2)  FACTOR   REMARKS
---------         ---------    ----------   ---------  ------   -------
LOW FLOW LINING
BOTTOM; STRAIGHT   SYNTHETIC MAT     2.00      1.12      1.78   STABLE

 *** NORMAL END OF HYCHL ***
```

```
******  HYCHL  ****** (Version 6.1) ******           Date 10-25-2011
 Commands Read From File: C:\HYDRAIN\HYCHL\4559-SW3.CHL

       JOB BLOOM SWM3
       UNI 0
 ** UNITS PARAMETER = 0 (ENGLISH)
       CHL .33    17
       TRP 40 3 3
 ** LEFT SIDE SLOPE    3.0 AND RIGHT SIDE SLOPE    3.0
 ** THE BASE WIDTH OF THE TRAPEZOID (ft)   40.00
       N   .03 .03
 ** LOW  FLOW N VALUE=  .030
 ** SIDE SLOPE N VALUE=  .030
       LTM 7
       END
***************END OF COMMAND FILE************

 BLOOM SWM3
 ------------
 INPUT REVIEW
 ------------
   DESIGN PARAMETERS:
       DESIGN DISCHARGE (ft^3/s):           17.00
       CHANNEL SHAPE:                  TRAPEZOIDAL
       CHANNEL SLOPE (ft/ft):               .330
 -----------------------------------------
 HYDRAULIC CALCULATIONS USING NORMAL DEPTH
 -----------------------------------------

                          DESIGN     MAXIMUM
                          ------     -------
 FLOW (cfs)                17.00       23.40
 DEPTH (ft)                  .08         .10
 AREA (ft^2)                3.23        3.91
 WETTED PERIMETER (ft)     40.51       40.61
 HYDRAULIC RADIUS (ft)       .08         .10
 VELOCITY (ft/s)            5.27        5.98
 MANNINGS N (LOW FLOW)       .030        .030

 ------------------
 STABILITY ANALYSIS
 ------------------

                  LINING       PERMIS SHR   CALC. SHR  STAB.
CONDITION         TYPE         (lb/ft^2)    (lb/ft^2)  FACTOR   REMARKS
---------         ---------    ----------   ---------  ------   -------
LOW FLOW LINING
BOTTOM; STRAIGHT   SYNTHETIC MAT     2.00      1.65      1.21   STABLE

 *** NORMAL END OF HYCHL ***
```

```
******  HYCHL  ****** (Version 6.1) ******          Date 10-25-2011
 Commands Read From File: C:\HYDRAIN\HYCHL\4559-SWL.CHL

       JOB BLOOM SWALE
       UNI 0
 ** UNITS PARAMETER = 0 (ENGLISH)
       CHL .010   87
       TRP 8 3 3
 ** LEFT SIDE SLOPE    3.0 AND RIGHT SIDE SLOPE    3.0
 ** THE BASE WIDTH OF THE TRAPEZOID (ft)    8.00
       N   .03 .03
 ** LOW  FLOW N VALUE=  .030
 ** SIDE SLOPE N VALUE=  .030
       LTM 5
       END
***************END OF COMMAND FILE************

 BLOOM SWALE
 ------------
 INPUT REVIEW
 ------------
   DESIGN PARAMETERS:
       DESIGN DISCHARGE (ft^3/s):           87.00
       CHANNEL SHAPE:                  TRAPEZOIDAL
       CHANNEL SLOPE (ft/ft):               .010
 -----------------------------------------
 HYDRAULIC CALCULATIONS USING NORMAL DEPTH
 -----------------------------------------

                          DESIGN     MAXIMUM
                          ------     -------
 FLOW (cfs)                87.00      229.08
 DEPTH (ft)                 1.41        2.32
 AREA (ft^2)               17.32       34.79
 WETTED PERIMETER (ft)     16.94       22.70
 HYDRAULIC RADIUS (ft)      1.02        1.53
 VELOCITY (ft/s)            5.02        6.58
 MANNINGS N (LOW FLOW)       .030        .030

 ------------------
 STABILITY ANALYSIS
 ------------------

                  LINING       PERMIS SHR   CALC. SHR  STAB.
 CONDITION        TYPE         (lb/ft^2)    (lb/ft^2)  FACTOR   REMARKS
 ---------        ---------    ----------   ---------  ------   -------
 LOW FLOW LINING
 BOTTOM; STRAIGHT   STRAW WITH NET    1.45       .88      1.64   STABLE

 *** NORMAL END OF HYCHL ***
```

```
******  HYCHL  ****** (Version 6.1) ******          Date 10-25-2011
 Commands Read From File: C:\HYDRAIN\HYCHL\4559-RR.CHL

       JOB BLOOM RIPRAP
       UNI 0
 ** UNITS PARAMETER = 0 (ENGLISH)
       CHL .007   24
       TRP 26 10 10
 ** LEFT SIDE SLOPE   10.0 AND RIGHT SIDE SLOPE   10.0
 ** THE BASE WIDTH OF THE TRAPEZOID (ft)   26.00
       N   .03 .03
 ** LOW  FLOW N VALUE=  .030
 ** SIDE SLOPE N VALUE=  .030
       PSS .6      .6
 ** USER SUPPLIED -  LOW PERMIS. SHEAR = (lb/ft^2)    .60
 ** USER SUPPLIED - HIGH PERMIS. SHEAR = (lb/ft^2)    .60
       LVG D
       END
***************END OF COMMAND FILE************

 BLOOM RIPRAP
 ------------
 INPUT REVIEW
 ------------
   DESIGN PARAMETERS:
       DESIGN DISCHARGE (ft^3/s):           24.00
       CHANNEL SHAPE:                  TRAPEZOIDAL
       CHANNEL SLOPE (ft/ft):               .007
 -----------------------------------------
 HYDRAULIC CALCULATIONS USING NORMAL DEPTH
 -----------------------------------------

                          DESIGN     MAXIMUM
                          ------     -------
 FLOW (cfs)                24.00      228.93
 DEPTH (ft)                  .39        1.37
 AREA (ft^2)               11.75       54.58
 WETTED PERIMETER (ft)     33.89       53.61
 HYDRAULIC RADIUS (ft)       .35        1.02
 VELOCITY (ft/s)            2.04        4.19
 MANNINGS N (LOW FLOW)       .030        .030

 ------------------
 STABILITY ANALYSIS
 ------------------

                  LINING       PERMIS SHR   CALC. SHR  STAB.
CONDITION         TYPE         (lb/ft^2)    (lb/ft^2)  FACTOR   REMARKS
---------         ---------    ----------   ---------  ------   -------
LOW FLOW LINING
BOTTOM; STRAIGHT   VEGETATIVE  D     .60        .17      3.50   STABLE

 *** NORMAL END OF HYCHL ***
```

(Tw < 0.5 Dia.)



NOTE: Curves should not be extrapolated; min. d50 = 6"

Figure 3.3.10a Design of outflet protection from a round pipe flowing full, minimum tailwater condition
Source: USDA-NRCS


OUTFALL SWM AREA #1

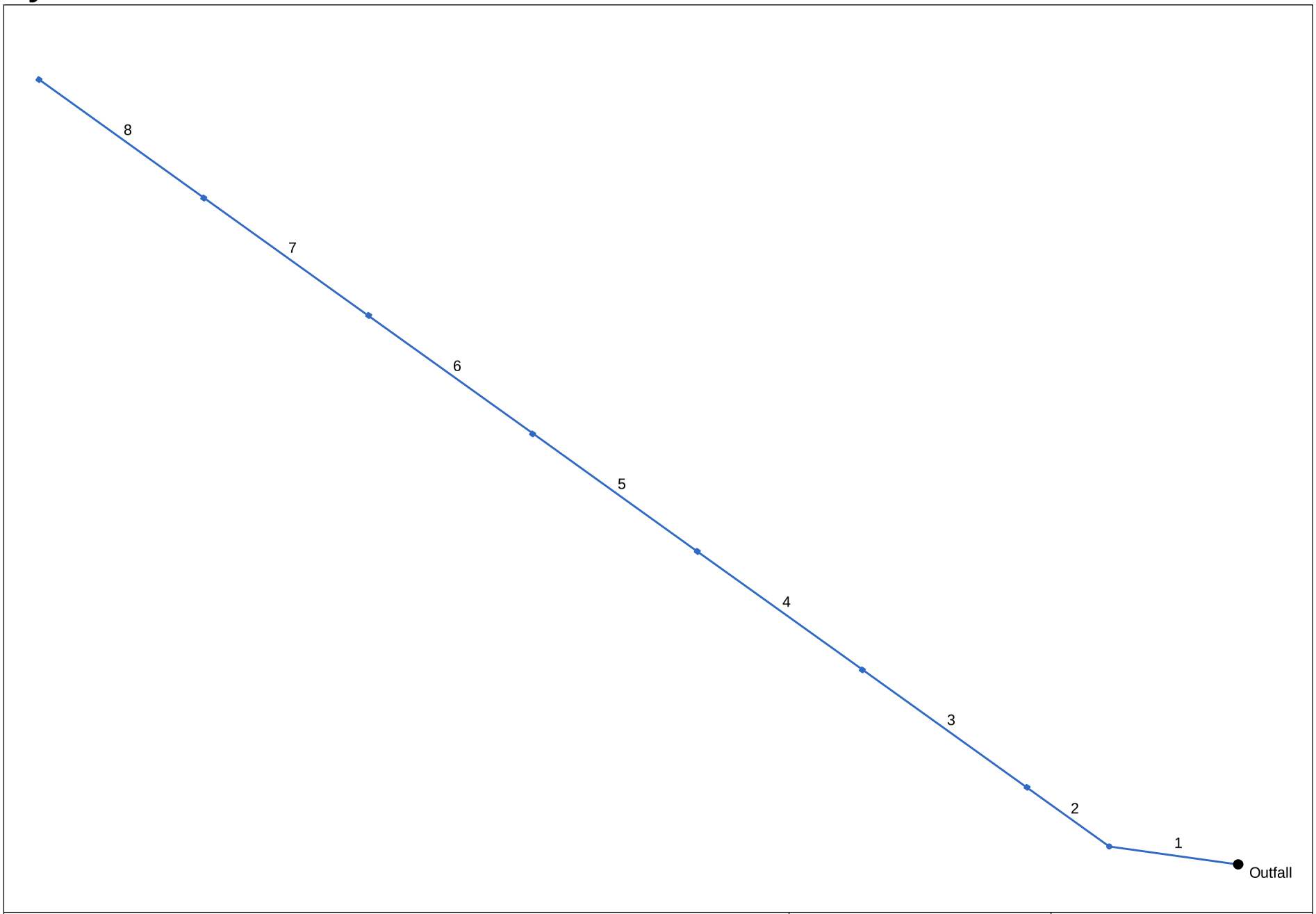

OUTFALL SWM AREA #2


OUTFALL SWM AREA #3


OUTFALL FOR SWALE


OUTFALL STORM SEWER

Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2009 Plan



Project File: pipe.stm	Number of lines: 8	Date: 07-12-2011

Hydraflow Storm Sewers Extension v6.066

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr line No.	Line length (ft)	Defl angle (deg)	Junc type	Known Q (cfs)	Drng area (ac)	Runoff coeff (C)	Inlet time (min)	Invert El Dn (ft)	Line slope (%)	Invert El Up (ft)	Line size (in)	Line shape	N value (n)	J-loss coeff (K)	Inlet/ Rim El (ft)	
1	End	128.000	-172.000	MH	0.00	0.00	0.00	30.0	13.50	2.93	17.25	24	Cir	0.011	0.53	25.90	
2	1	100.000	28.000	DrGrt	0.00	0.53	0.40	10.0	17.25	0.35	17.60	24	Cir	0.011	0.50	25.25	
3	2	200.000	0.000	DrGrt	0.00	0.72	0.40	10.0	17.60	0.32	18.25	24	Cir	0.011	0.50	25.25	
4	3	200.000	0.000	DrGrt	0.00	0.37	0.40	10.0	18.25	0.30	18.85	24	Cir	0.011	0.50	25.25	
5	4	200.000	0.000	DrGrt	0.00	0.44	0.40	10.0	18.85	0.30	19.45	24	Cir	0.011	0.50	25.25	
6	5	200.000	0.000	DrGrt	0.00	0.69	0.40	10.0	19.45	0.32	20.10	24	Cir	0.011	0.50	25.25	
7	6	200.000	0.000	DrGrt	0.00	0.82	0.40	10.0	20.10	0.30	20.70	24	Cir	0.011	0.50	25.25	
8	7	200.000	0.000	DrGrt	0.00	5.50	0.40	10.0	20.70	0.28	21.25	24	Cir	0.011	1.00	25.25	

Project File: pipe.stm | Number of lines: 8 | Date: 07-12-2011

Storm Sewer Tabulation

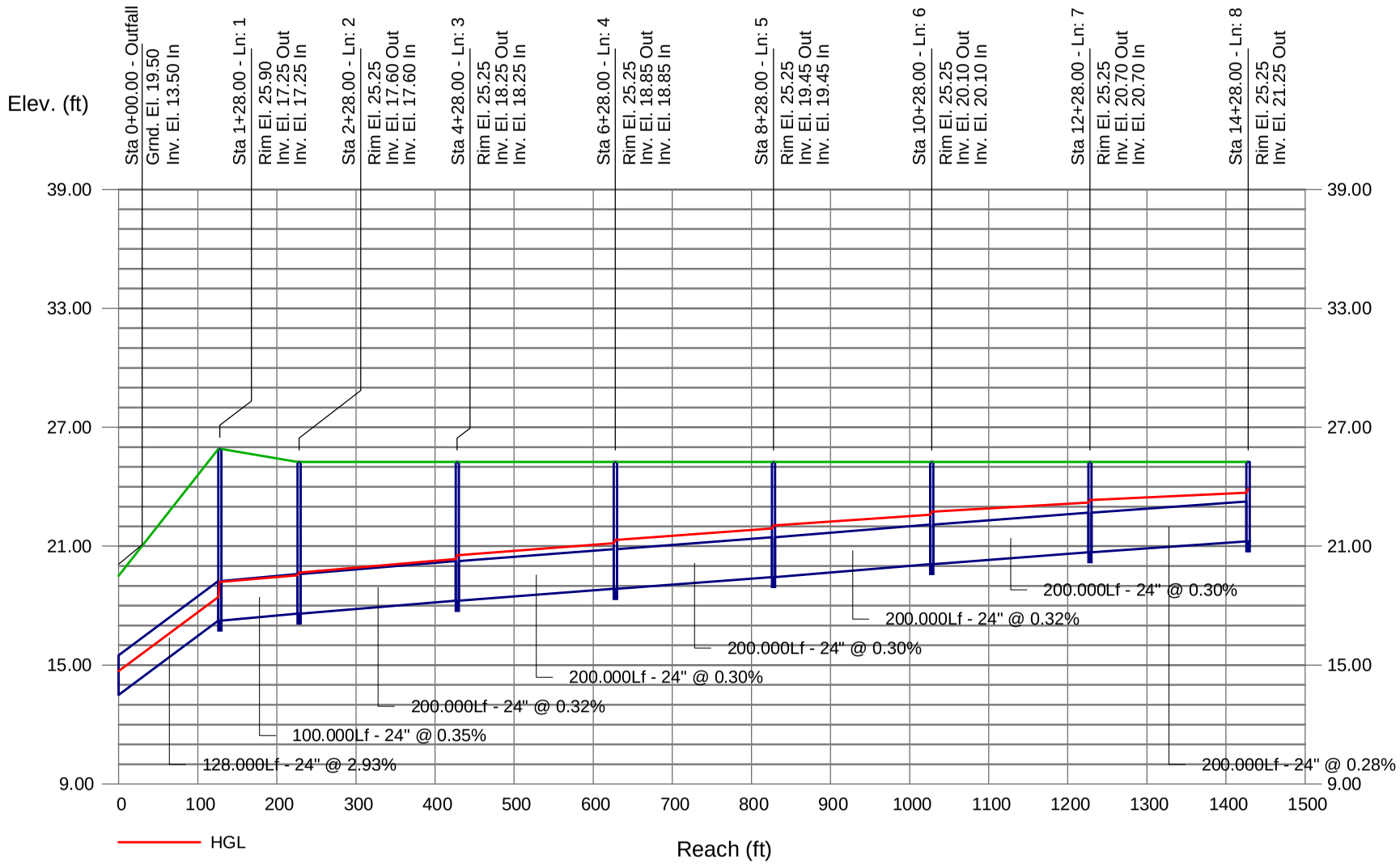
Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	128.000	0.00	9.07	0.00	0.00	3.63	30.0	30.0	3.1	11.36	45.73	5.81	24	2.93	13.50	17.25	14.69	18.44	0.00	25.90	
2	1	100.000	0.53	9.07	0.40	0.21	3.63	10.0	14.7	4.5	16.27	15.81	5.22	24	0.35	17.25	17.60	19.21	19.53	25.90	25.25	
3	2	200.000	0.72	8.54	0.40	0.29	3.42	10.0	14.0	4.6	15.65	15.24	4.98	24	0.32	17.60	18.25	19.67	20.36	25.25	25.25	
4	3	200.000	0.37	7.82	0.40	0.15	3.13	10.0	13.3	4.7	14.66	14.64	4.67	24	0.30	18.25	18.85	20.55	21.15	25.25	25.25	
5	4	200.000	0.44	7.45	0.40	0.18	2.98	10.0	12.5	4.8	14.31	14.64	4.56	24	0.30	18.85	19.45	21.32	21.89	25.25	25.25	
6	5	200.000	0.69	7.01	0.40	0.28	2.80	10.0	11.7	4.9	13.81	15.24	4.40	24	0.32	19.45	20.10	22.06	22.59	25.25	25.25	
7	6	200.000	0.82	6.32	0.40	0.33	2.53	10.0	10.9	5.1	12.81	14.64	4.08	24	0.30	20.10	20.70	22.74	23.20	25.25	25.25	
8	7	200.000	5.50	5.50	0.40	2.20	2.20	10.0	10.0	5.2	11.51	14.02	3.66	24	0.28	20.70	21.25	23.33	23.70	25.25	25.25	

Project File: pipe.stm | Number of lines: 8 | Run Date: 07-12-2011

NOTES: Intensity = 60.92 / (Inlet time + 12.00) ^ 0.79; Return period = 10 Yrs. ; c = cir e = ellip b = box

Storm Sewer Profile

Proj. file: pipe.stm



Hydraflow Storm Sewers Extension

Storm Sewer Tabulation

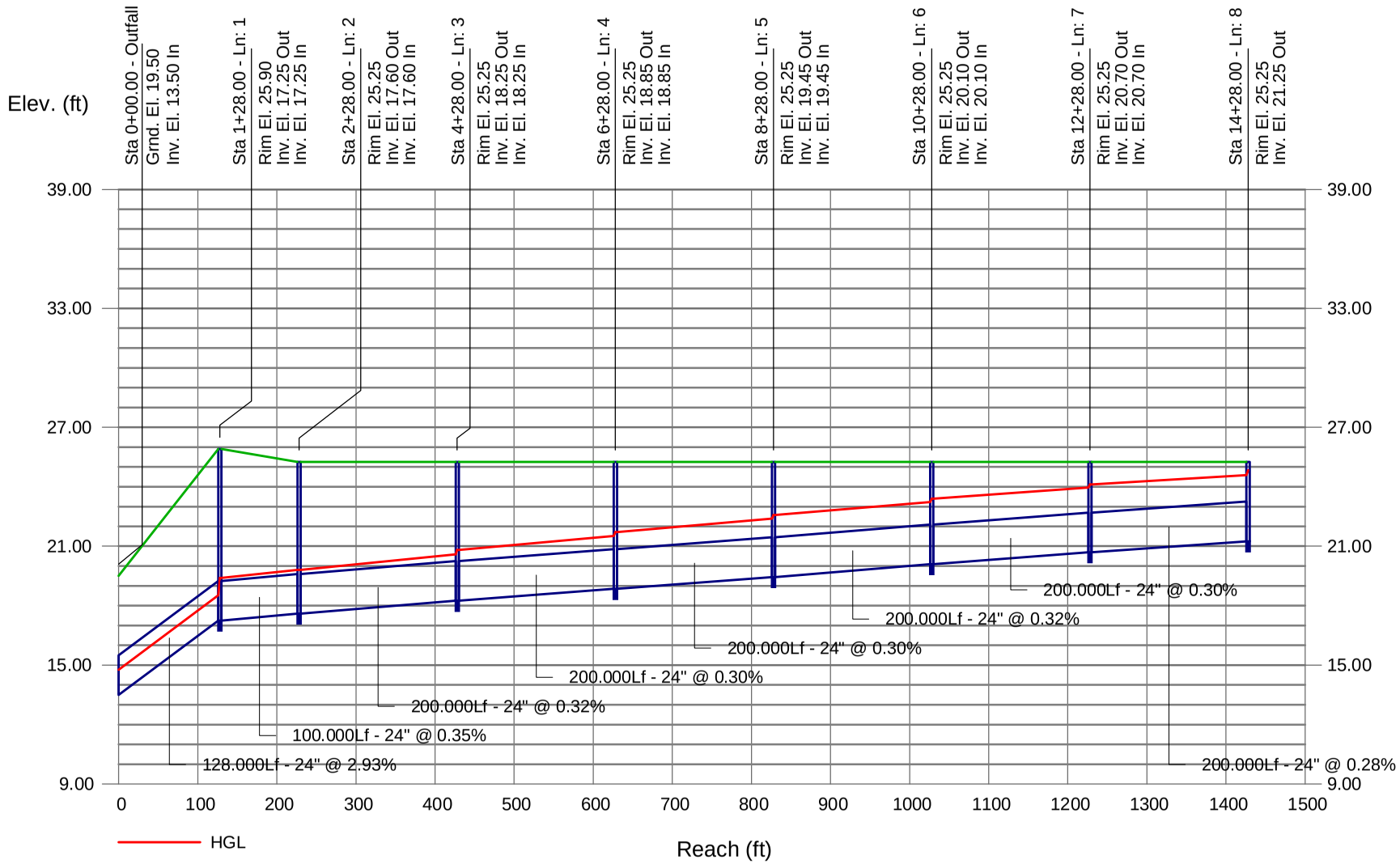
Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	128.000	0.00	9.07	0.00	0.00	3.63	30.0	30.0	3.6	12.88	45.73	6.11	24	2.93	13.50	17.25	14.77	18.52	0.00	25.90	
2	1	100.000	0.53	9.07	0.40	0.21	3.63	10.0	16.7	4.7	17.22	15.81	5.48	24	0.35	17.25	17.60	19.39	19.81	25.90	25.25	
3	2	200.000	0.72	8.54	0.40	0.29	3.42	10.0	15.6	4.9	16.71	15.24	5.32	24	0.32	17.60	18.25	19.81	20.59	25.25	25.25	
4	3	200.000	0.37	7.82	0.40	0.15	3.13	10.0	14.4	5.0	15.80	14.64	5.03	24	0.30	18.25	18.85	20.81	21.51	25.25	25.25	
5	4	200.000	0.44	7.45	0.40	0.18	2.98	10.0	13.3	5.2	15.55	14.64	4.95	24	0.30	18.85	19.45	21.71	22.39	25.25	25.25	
6	5	200.000	0.69	7.01	0.40	0.28	2.80	10.0	12.2	5.4	15.15	15.24	4.82	24	0.32	19.45	20.10	22.58	23.22	25.25	25.25	
7	6	200.000	0.82	6.32	0.40	0.33	2.53	10.0	11.1	5.6	14.17	14.64	4.51	24	0.30	20.10	20.70	23.40	23.96	25.25	25.25	
8	7	200.000	5.50	5.50	0.40	2.20	2.20	10.0	10.0	5.8	12.81	14.02	4.08	24	0.28	20.70	21.25	24.12	24.58	25.25	25.25	

Project File: pipe.stm | Number of lines: 8 | Run Date: 07-12-2011

NOTES: Intensity = 53.45 / (Inlet time + 10.70) ^ 0.73; Return period = 25 Yrs. ; c = cir e = ellip b = box

Storm Sewer Profile

Proj. file: pipe.stm

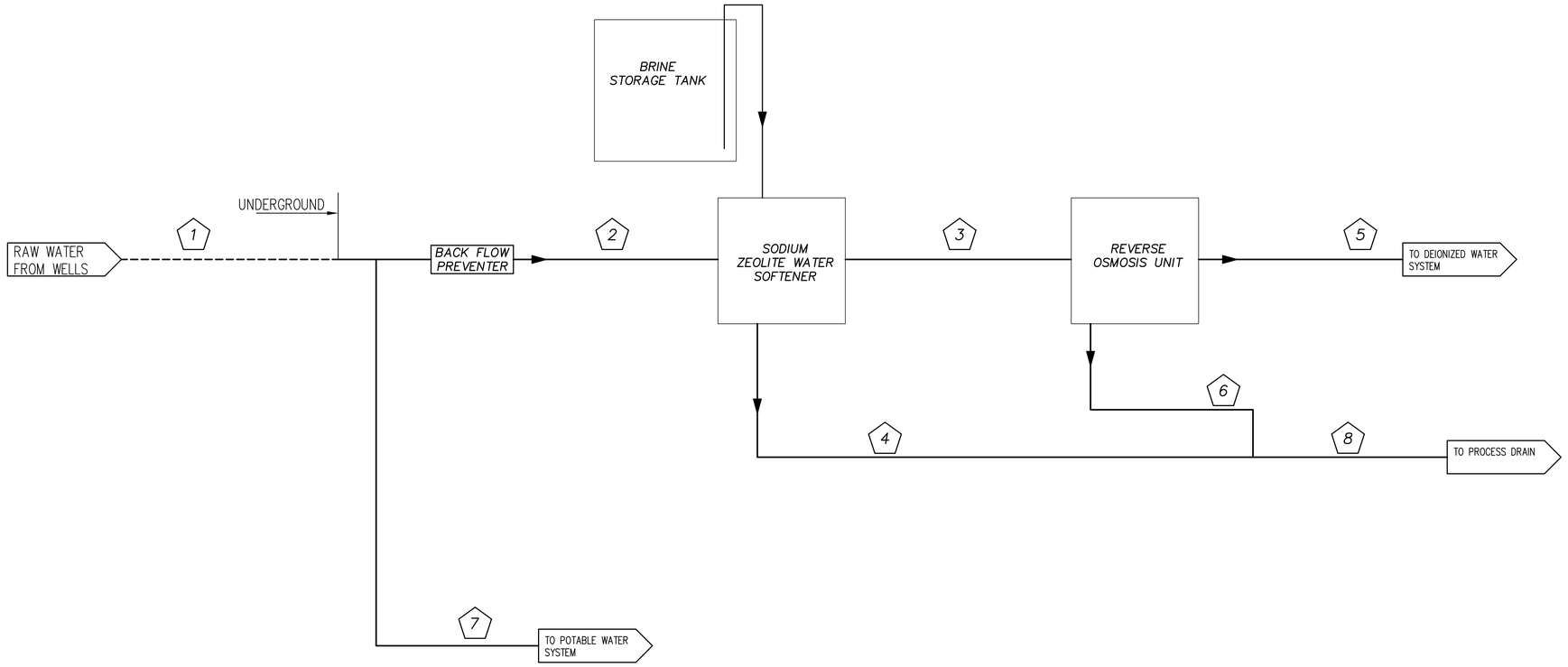


Hydraflow Storm Sewers Extension

ATTACHMENT D

WATER PROCESS FLOW DIAGRAM

PROCESS FLOW DIAGRAM WITH SOFTENER



WATER FLOW TABLE (GPM)					
SYMBOL	DESIGNATION	NORMAL FLOW YEAR 0	NORMAL FLOW YEAR 5	MAXIMUM FLOW	MAXIMUM FLOW W/SOFTENER REGENERATING
1	RAW WATER	0	12	62	77
2	PROCESS WATER INLET	0	12	21	36
3	SOFT WATER OUTLET	0	12	21	21
4	SOFTENER BACKWASH	0	0	0	15
5	DEIONIZED WATER	0	8	15	15
6	R.O. REJECTION	0	4	6	6
7	POTABLE WATER	0	0	41	41
8	PROCESS DRAIN	0	4	6	21

WORKING REV
10-12-2011

No.	Date	Description
R1	10/12/11	INCORPORATE CLIENT COMMENTS
R0	09/30/11	ISSUED FOR REVIEW

REVISIONS:

Michael Fischette P. E.
Delaware P. E. No. 9184

Michael Fischette P. E.

CONCORD ENGINEERING
P.A. 24GA27936700
520 South Burnt Mill Road
Voorhees, New Jersey 08043
(856) 427-0200
www.concord-engineering.com

KEY PLAN:

N

PROJECT:

CLIENT:
Diamond State Generation Partners, LLC

FUEL CELL PROJECT
DELMARVA POWER

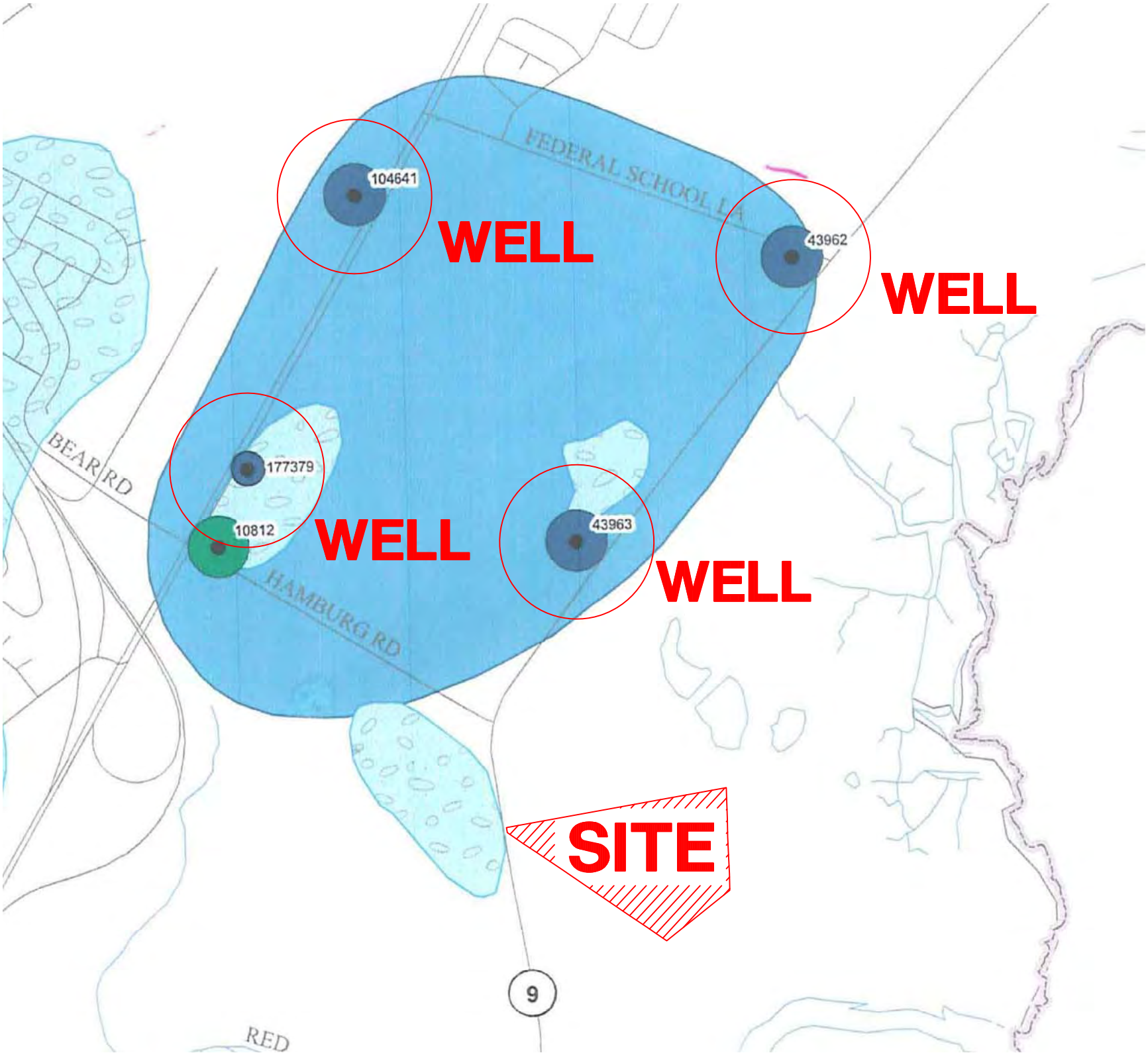
DRAWING TITLE:

MECHANICAL
WATER & WASTE WATER
PROCESS FLOW DIAGRAM

PROJ. No.:	2C11070	DRAWING No.:	M103
SCALE:	AS NOTED		
DRAWN BY:	RMT		
CHECK BY:	EDS		
DATE:	/ 0/ 30 2011	SHEET:	OF

ATTACHMENT E

LOCATION OF NEARBY EXISTING GROUNDWATER WELLS


104641
WELL
FEDERAL SCHOOL LA
43962
WELL
BEAR RD
177379
10812
WELL
43963
WELL
HAMBURG RD
SITE
9
RED

ATTACHMENT F

LETTER FROM STATE OF DELAWARE NATURAL HERITAGE PROGRAM

TO FOLLOW

Historical, Cultural and Archeological Resources

Duffield Associates, Inc. (Duffield Associates) reviewed available information to ascertain whether identified historic and cultural resources are located in proximity to 1593 River Road (the "Property"). The information reviewed included:

- State of Delaware, Division of Historical and Cultural Affairs websites:
  http://history.delaware.gov/museums/historic_sites.shtml
  http://history.delaware.gov/archaeology/default.shtml

- City of New Castle, New Castle Historical Society website:
  http://www.newcastlecity.org/nc_hs/nc_hs.html

- Historic aerial photographs available through the Delaware DataMil website:
  http://datamil.delaware.gov/geonetwork/srv/en/main.home

Duffield Associates researched the State of Delaware's Division of Historical and Cultural Affair's websites for the nearest historical sites owned by the State of Delaware and for articles regarding archeological sites. The two closest sites were the Hale-Byrnes House, at 606 Stanton-Christiana Road, Wilmington, Delaware, and Pencader Heritage Museum, at 2029 Sunset Lake Road, Newark, Delaware. The approximate distance from the site for both historical landmarks was approximately 7 miles. No archeological interests were found for the Property or adjoining properties.

Information regarding the City of New Castle was also investigated due to historical sites present there. The New Castle Historical Society website was reviewed and provided information for downtown New Castle, locating multiple areas adjacent to Delaware Street, New Castle, Delaware. The approximate distance from the property to downtown New Castle is approximately 5 miles.

Aerial photographs were reviewed by Duffield Associates dating 1937, 1954, 1961, 1968, 1992, 1997, 2002, 2007, and 2010. According to the aerial photographs, the Property, specifically the area where proposed development is to take place, appears to have been tilled farmland for at least the past 74 years. No structures were observed on the property in the photographs reviewed. Typically, tilling disturbs the upper 2 to 3 feet of soil. From an archeological perspective, this disturbance would dislocate artifacts, if present, from the original site context, thereby limiting the archeological value of any finds. The land disturbing activities associated with the proposed project, such as grading, generally are anticipated to be confined to the upper 2 to 3 feet of the site.

Based on the information reviewed, no known archeological, historical, or cultural sites are proximate to the project site. The project has limited potential to disturb previously unidentified archeological resources, if they are present. As such, the project is not expected to impact historical, cultural or archeological resources.

ATTACHMENT G

OFFSET MATRIX

COASTAL ZONE ENVIRONMENTAL IMPACT OFFSET MATRIX

Applicant:
Project:
CZA Offset Review Reference: (DNREC Only)

Application Date:
Amendments:
Offset Review Date: (DNREC Use Only)
Matrix Amended:

ENVIRONMENTAL IMPACTS	(Applicant's Use) DESCRIBE ENVIRONMENTAL IMPACTS	PAGE NO.	(Applicant's Use) DESCRIBE ENVIRONMENTAL OFFSET PROPOSAL[1]	PAGE NO.	(DNREC Use Only) OFFSET SUFFICIENCY Yes, No or N/A
Air Quality (Applicant to List Below by Parameter)	Nitrogen oxides (NO_x), Carbon monoxide (CO), Carbon Dioxide (CO_2), Volatile Organic Compounds (VOCs)	12	Offset by reducing significantly larger discharges of the same and other pollutants		
	Water Vapor (H_2O)		from other generating facilities in the PJM grid.		
Water Quality					
Surface	None		Reduction in nutrient and sediment load in storm water runoff due to reduction in agricultural use.		
Groundwater	Discharge of process wastewater from water treatment (enhanced dissolved solids). Sanitary wastewater discharge (nutrients).	13	Reduction in nutrient discharges through reduction of fertilizer applications		
Water Quantity					
Surface	None				
Groundwater	Water withdrawal for worker consumption and equipment cooling	16	Return of worker consumption water and process wastewater from water treatment system	16	
Water Use For:					
Processing	18,130 gallons per year (50 gpd) on average as treatment reject water.	16			
Cooling	888,700 gallons per year (2,435 gpd) on average	16			
Effluent Removal					
Solid Waste	Office wastes (paper, metals, glass, plastics, electronic equipment)	17	Voluntary recycling of office wastes		
Hazardous Waste	None	18			
Habitat					
Wetlands	None	19			
Flora Fauna	None				
Drainage/Flood Control	None				
Erosion[2]	None				
Land Use Effects					
Glare	None	21			
Heat	None	21			
Noise	None	21			
Odors	None	21			
Vibration	None	21			
Radiation	None	21			
Electro-Magnetic Interference	None	21			
Other Effects					
Threatened & Endangered Species	None	19			
Impacts From:					
Raw Material	None	9			
Intermediate Products	No intermediate products	9			
By-Products	Water vapor, air emissions, process wastewater from water treatment system	9			
Final Products	None	9			

1 See paragraph I.1.b in "Secretary Assessment"

2 Construction and normal operation

Environmental Offsets Resulting From the Bloom Energy Red Lion Project

Bloom Energy proposes that air emissions will be offset by the installation of the 235 ES-5700 Energy Saver fuel cells to produce electrical power at the Red Lion facility and that reduction in air emission will offset the minor negative impacts from the project. The 235 ES-5700 fuel cells will have a rated generating capacity (power capacity) of 47 megawatts (MW). The estimated annual energy production from the facility, expressed in units of megawatt-hours (MWh), is 411,720 MWh. This energy production value is based on operating the facility 365 days per year, 24 hours per day at the rated power capacity of 47 MW, which is the project goal. These power capacity and estimated annual energy production values are used throughout this offset assessment.

The fuel cells will react the methane in natural gas with the oxygen in air chemically to produce electricity. Methane is composed of one carbon atom and four hydrogen atoms. The movement (flow) of electrons donated from oxygen in the fuel cell is the basis of electricity production.

In the chemical reaction, hydrogen atoms released from methane will combine with oxygen atoms in air to form water (H_2O). The water produced by the process is sufficient to control the temperature of the fuel cells and heat incoming air to support the chemical reaction. The carbon atoms released from methane will react with oxygen atoms in air to form carbon dioxide (CO_2) and carbon monoxide (CO). Other emissions from the process directly relate to the presence of other substances in natural gas and are categorized per the federal Clean Air Act as sulfur oxides (SO_x), nitrogen oxides (NO_x) and volatile organic compounds (VOCs). Those other substances pass through the system and are discharged to the atmosphere with the water vapor, carbon dioxide and carbon monoxide. According to the U.S. Environmental Protection Agency publication AP-42, the VOCs in natural gas commonly are ethane, propane and butane, which are gaseous petroleum hydrocarbons.

The new Bloom Energy power generating facility will be connected to the Pennsylvania-New Jersey-Maryland electrical distribution grid (PJM grid), which serves Delaware. Electricity is produced for the grid to meet the demand for electric power within the grid service area. The grid operates to balance the production of electricity with the demand for electricity. As such, the 47 MW of electrical power produced by the fuel cells will replace 47 MW produced by fossil fuel-based facilities that satisfy current demand within the PJM grid. The air emissions attributable to the proposed fuel cells are substantially less than air emissions produced by other existing fossil fuel (natural gas, oil and coal) based electricity production devices that the proposed project will offset. The offset will be realized at the same time that the fuel cells become operational.

To demonstrate and quantify the value of the proposed offsets from this project, Table 1 presents the estimated air emissions from the 235 ES-5700 fuel cells and composite average PJM emissions for an equivalent amount of power capacity (47 MW). The PJM average emissions, as published by PJM, are used in this table, when available, as a

conservative measure. The actual devices and emissions from those devices that will not be operated within the PJM grid may vary. Therefore, the use of the composite average emission values are appropriate, where they are available. These average values are based on all power production facilities now supplying power to the PJM grid, including, but not limited to, technologies based on wind, nuclear, solar, hydro, natural gas, oil, and coal.

Average PJM values for carbon monoxide (CO) and volatile organic compounds (VOC) are not available. To quantify comparison values for these substances, electricity production from natural gas fired power plants are used and the results are summarized in Table 2. Typically, the emissions attributable to gas-fired electricity production are the lowest of the fossil fuel based power plants. As such, where those emissions are used in the comparison, the value of the off-set probably is understated. Coal or petroleum fired electricity production more likely will be offset by the Bloom Energy project, as the costs associated with operating those types of power plants typically are higher than natural gas fired power plants.

The Bloom facility will not emit metals, particulate matter, polynuclear aromatic hydrocarbons, hazardous air pollutants or volatile organic compounds that are generated by combustion processes based on coal or petroleum fuels. A listing of substances that the U.S. Environmental Protection Agency associates with coal and petroleum combustion in electricity production plants is summarized in Table 3. The emissions avoided by the power produced by the Bloom facility are also summarized in Table 3. The avoided emissions (100% offset) provided in Table 3 are based on an equivalent amount of annual electricity production (411,720 MWh).

In summary, operation of the Bloom Energy facility will result in the reduction of 0.56 million lbs of NO_x emissions and 2.2 million pounds of SO_x emissions from current production of those emissions within the PJM grid. The offset ratios specifically associated with those smog and acid rain forming substances are 651:1 for NO_x and 155:1 for SO_x. Operation of the Bloom facility will also offset production of CO at a ratio of at least 3.2 to 1. The Bloom Energy facility, when operating, will avoid: tens of thousands to billions of pounds of particulate matter emissions; hundreds of pounds of metals emissions; hundreds to thousands of pounds of polynuclear aromatic hydrocarbon emissions; and thousands of pounds of volatile organic compound emissions that would otherwise be produced within the PJM grid by petroleum or coal fired electrical power plants to satisfy the current demand for electrical energy.

SUMMARY OF OFFSETS
FOR
BLOOM ENERGY RED LION PROJECT
New Castle County, Delaware

Table 1. Offset of Average PJM Grid Emissions

Emission Type	Bloom Energy ES-5700 emissions (235 units)			Avoided PJM Emissions			Emissions Reductions		Offset Ratio
	Emission Rate	Emissions at 47 MW		Average Emission Rate*	Average Emissions at 47 MW		Daily	Annual	
	(lbs/MWh)	Daily: (lbs/day)	Annual: (lbs/year)	(lbs/MWh)	Daily: (lbs/day)	Annual: (lbs/year)	(lbs/day)	(lbs/year)	
Sulfur Dioxide (SO_2)	0.035	0	0	5.41	0	0	0	0	#DIV/0!
Nitrogen Oxides (NO_x)	0.0021	0	0	1.37	0	0	0	0	#DIV/0!
Carbon Dioxide (CO_2)	884	0	0	1,181	0	0	0	0	#DIV/0!
Carbon Monoxide (CO)	0.1	0	0	NVA	---	---	---	---	---
Volatile Organic Compounds (VOC)	0.02	0	0	NVA	---	---	---	---	---

1. Annual Energy Production = 411,720 MWh
2. Daily Energy Production = 24 hrs * 47 MW = 1,128 MWh
3. PJM emissions as published on the PJM website in a fact sheet, dated May 20, 2011, titled, "District of Columbia, Fuel Mix and Emissions Disclosure Report, Customers of MidAmerican Energy Company." Per the notes for the table, the values presented represent calendar year 2010 generation and emissions within PJM. Copy Attached.
4. NVA = No Value Available
5. lbs = pounds
6. MW = megawatts (measure of power)
7. MWh = megawatt-hours (measure of energy)

Table 2. Offset of Emissions from Typical Natural Gas-Fired Generating Plant in PJM Grid

Emission Type	Bloom Energy ES-5700 emissions (235 units)			Natural Gas Powered Turbine Emissions			Emissions Reductions		Offset Ratio
	Emission Rate	Emissions at 47 MW		Average Emission Rate	Average Emissions at 47 MW		Daily	Annual	
	(lbs/MWh)	Daily: (lbs/day)	Annual: (lbs/year)	(lbs/MWh)	Daily: (lbs/day)	Annual: (lbs/year)	(lbs/day)	(lbs/year)	
Carbon Monoxide (CO, Uncontrolled)	0.1	112.8	41,172	1	971	354,491	858	313,319	8.6
Carbon Monoxide (CO, Steam Injected)	0.1	112.8	41,172	0.315	355	129,692	243	88,520	3.2
Volatile Organic Compounds (VOC)	0.02	22.56	8,234	0.0002205	0.249	91	-22	-8,144	0.011

Table 3. Emissions from Typical PJM Gird Petroleum and Coal Fired Generating Plants Offset By Bloom Facility

Emission Type	Disillate Oil (Diesel) Turbine				Controlled Coal Combustion (Bituminous/Subbituminous)			
	lb/MBtu	lb/MWh	lb/day	lb/yr	lb/MBtu[1]	lb/MWh	lb/day	lb/yr
Particulate Matter, condensable ($PM_{2.5}$ or smaller)	0.007200	0.075600	0.00000	**0.00**	0.010	0.105	0	**0**
Particulate Matter, filterable (PM_{10} or $PM_{2.5}$)	0.004300	0.045150	0.00000	**0.00**	0.214	2.25	0	**0**
Trace Metals								
Antimony	NVA	---	---	---	0.0000006	0.0000068	0.00	**0**
Arsenic	0.000011	0.000116	0.00000	**0.00**	0.0000146	0.0001538	0.00	**0**
Beryllium	0.000000	0.000003	0.00000	**0.00**	0.0000008	0.0000079	0.00	**0**
Cadmium	0.000005	0.000050	0.00000	**0.00**	0.0000018	0.0000191	0.00	**0**
Chromium	0.000011	0.000116	0.00000	**0.00**	0.0000093	0.0000975	0.00	**0**
Chromium (VI)	NVA	---	---	---	0.0000028	0.0000296	0.00	**0**
Cobalt	NVA	---	---	---	0.0000036	0.0000375	0.00	**0**
Lead	0.000014	0.000147	0.00000	**0.00**	0.0000150	0.0001575	0.00	**0**
Magnesium	NVA	---	---	---	0.0003929	0.0041250	0.00	**0**
Manganese	0.000790	0.008295	0.00000	**0.00**	0.0000175	0.0001838	0.00	**0**
Mercury	0.000001	0.000013	0.00000	**0.00**	0.0000030	0.0000311	0.00	**0**
Nickel	0.000005	0.000048	0.00000	**0.00**	0.0000100	0.0001050	0.00	**0**
Selenium	0.000025	0.000263	0.00000	**0.00**	0.0000464	0.0004875	0.00	**0**
Total Polynuclear Aromatic Hydrocarbons (PAHs)	0.000040	0.000420	0.00000	**0.00**	Value summed from individual substance values			**0**
Total Volatile Organic Compounds (VOCs)	Value summed from individual substance values			**0.00**	Value summed from individual substance values			**0**

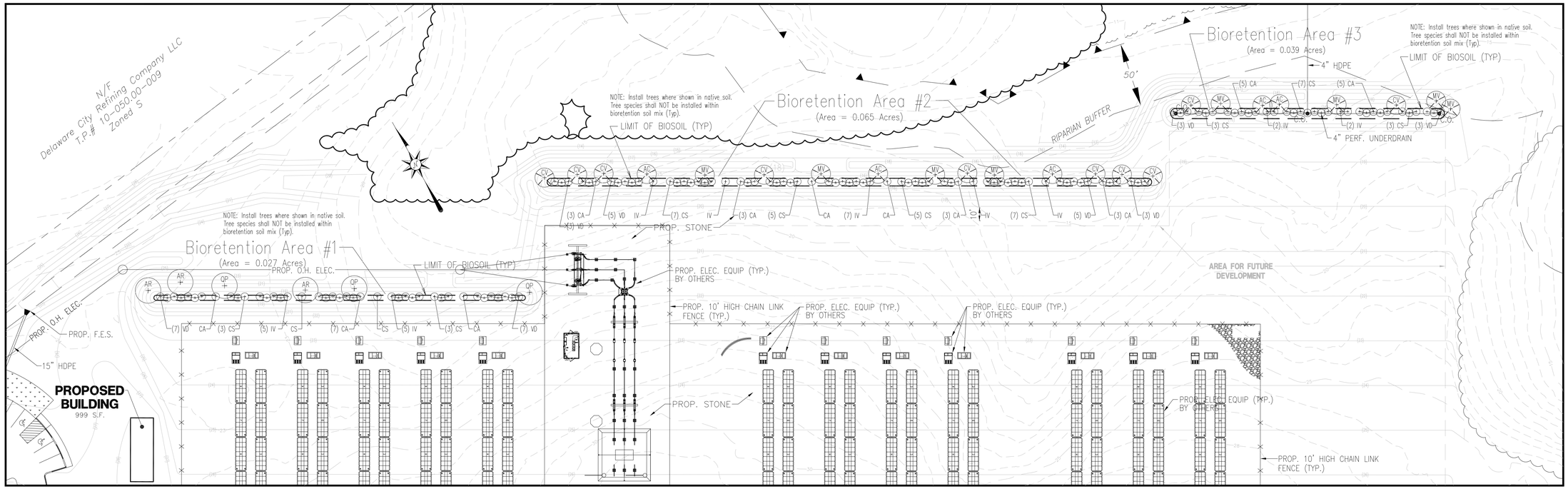
1. Values provided by EPAs AP-4 Emissions Factors were in lb/ton coal and are presented here in lb/Mbtu using the following conversion factors: 0.014 MBtu/lb coal; 2000 lb/ton
2. The average amount of coal ash in the US is 10% weight according to the USGS (http://pubs.usgs.gov/fs/1997/fs163-97/FS-163-97.html).
3. Condensable particulate matter (PM) value is based on coal with a sulfur content of less than 0.4%, which was smallest available value.
4. NVA = No Value Available.
5. MBtu = million British thermal units

ATTACHMENT H

LANDSCAPING PLAN

LEGEND

- EXIST. FOREST EDGE (TO REMAIN)
- EXIST. FOREST EDGE (TO BE REMOVED)
- PROP. FOREST EDGE
- EXISTING CANOPY TREE
- EXISTING EVERGREEN TREE
- PROPOSED CANOPY TREE
- PROPOSED UNDERSTORY TREE
- PROPOSED EVERGREEN TREE
- PROPOSED SHRUB
- PROPOSED CANOPY TREE FOR RBA REFORESTATION



PARTIAL SITE PLAN: BIORETENTION FACILITIES PLANTING

SCALE: 1" = 40 ft.

LANDSCAPING CALCULATIONS:

BIORETENTION AREA LANDSCAPING:

TYPE / LOCATION	Performance Standard	Total Area	Minimum Planting Reqs.	Required Plant Types	Vegetation Credits Applied (Exist. or Proposed Trees & Shrubs)	Plants To Be Installed
Bioretention Area #1	1000 Plants/Acre (Trees & Shrubs)	0.027 Ac	27 Plants	6 Trees 21 Shrubs	0 Canopy, Evergreen or Understory Trees 0 Shrubs	6 Trees 21 Shrubs
Bioretention Area #2	1000 Plants/Acre (Trees & Shrubs)	0.065 Ac	65 Plants	13 Trees 52 Shrubs	0 Canopy, Evergreen or Understory Trees 0 Shrubs	13 Trees 52 Shrubs
Bioretention Area #3	1000 Plants/Acre (Trees & Shrubs)	0.039 Ac	39 Plants	8 Trees 31 Shrubs	0 Canopy, Evergreen or Understory Trees 0 Shrubs	8 Trees 31 Shrubs

NOTE: Bioretention Area vegetation credits include existing or proposed plants located in or around proposed bioretention facilities. Vegetation credits may include Existing trees & shrubs, or Proposed trees & shrubs otherwise required for Reforestation, Street Trees, Bufferyards, Parking Lots, or On-Lot landscaping.

LIST OF PROPOSED PLANTS: BIORETENTION FACILITIES

KEY	BOTANICAL NAME	COMMON NAME	NO.	SIZE	CALIPER	ROOT	REMARKS
	CANOPY TREES						
AR	Acer rubrum	Red Maple	3	xxxxx	2 to 2.5 in.	B&B	
QP	Quercus palustris	Pin Oak	3	xxxxx	2 to 2.5 in.	B&B	
	UNDERSTORY TREES						
AC	Amelanchier canadensis	Serviceberry	5	xxxxx	1.5 to 2 in.	B&B	Single or mult-stem trees acceptable
CV	Crataegus viridis 'Winterking'	Winterking Hawthorne	10	xxxxx	1.5 to 2 in.	B&B	Single or mult-stem trees acceptable
MV	Magnolia virginiana	Sweetbay Magnolia	8	xxxxx	1.5 to 2 in.	B&B	Single or mult-stem trees acceptable
	SHRUBS						
CA	Clethra alnifolia	Summersweet Clethra	33	18 in. (min)	xxxxx	Cont.	
CS	Cornus sericea	Redosier Dogwood	45	18 in. (min)	xxxxx	Cont.	
IV	Ilex verticillata	Common Winterberry	25	18 in. (min)	xxxxx	Cont.	
VD	Viburnum dentatum	Arrowwood Viburnum	36	18 in. (min)	xxxxx	Cont.	

NOTES:

- Plant caliper equals the diameter of a tree trunk measured at six (6) inches above the root ball.
- Unless otherwise noted, plant size refers to height, as measured from the top of the root ball to the highest branch.
- Plants for which no variety or cultivar are specified shall be typical of the species in both form and size at maturity.
- Planting Bed Preparation & Mulching: All proposed planting beds shall be tilled to a minimum depth of 8 inches. After initial tilling, 1 cubic yard of compost per 150 sq. ft. of bed area, shall be thoroughly tilled in to the soil. After bed preparation and plant installation, planting beds shall be mulched with a uniform 2 to 2.5 in. deep layer of shredded hardwood bark mulch.

NOTES

- Existing vegetation shown is to remain unless otherwise indicated on this, or the Record Plan.
- No Vegetation credits have been taken for any existing site vegetation.
- All proposed plant locations are to be determined by the installer by scaling off of the plan, and measuring in the field from known locations (buildings, curbs, walkways, etc.)
- The installer shall be responsible for ensuring that no street or canopy tree is planted under, or within 10 lateral feet of any overhead utility wire, or over or within 5 lateral feet of any underground water line, sewer line, transmission line, or other utility. In the event that a tree's proposed location conflicts with these restrictions, the installer shall stop work, and notify the landscape architect immediately, so that a solution can be determined.
- No lighting is indicated on this plan, or proposed for this project.

SITE DATA

TOTAL SITE AREA = 42.20 Acres
TOTAL BUILDING AREA = 0.11 Acres
- Existing Building Area = N/A
- Proposed Building Area = 0.11 Acres

TOTAL PAVED AREA = 6.82 Acres
- Existing Paved Area = N/A
- Proposed Paved Area = 6.82 Acres

TOTAL PARKING PROVIDED = 32 Spaces

SITE ZONING = S (Suburban)
SITE USE = Minor Utility (Local Substation)
MIN. LANDSCAPED SURFACE RATIO = 70%
LANDSCAPED SURFACE RATIO PROVIDED = 83.58%
LANDSCAPED SURFACE AREA PROVIDED = 35.27 Acres
- Bufferyard Area = TBD
- On-Lot Area = TBD

BIORETENTION FACILITIES MAINTENANCE CRITERIA & SPECIFICATIONS

BIORETENTION FACILITIES CONSTRUCTION

See "Specifications for Bioretention" on Site Construction Plan for construction of Bioretention areas.

MAINTENANCE CRITERIA:

Maintenance for bioretention facilities include inspection and/or repair or replacement of the treatment area components. Trees and shrubs shall be inspected twice per year to evaluate their health. Remove any dead or severely diseased vegetation. Diseased vegetation should be treated as necessary using preventative low-toxic measures to the extent possible. Pruning and weeding may also be necessary to maintain the treatment area's appearance.

Mulch shall be replaces when erosion is evident or when the site begins to look unattractive. Spot mulching may be adequate when there are random voic areas; However, once every two to three years the entire area may require mulch replacement. This should be done during the spring. The old mulch shall be removed before the new mulch is distributed. Old mulch shall be disposed of properly.

BIORETENTION MAINTENANCE SPECIFICATIONS

There shall be semi-annual regular inspections of the bioretention facility; once before new growth emerges in the spring, and once at seed dispersal in the fall. The bioretention facility shall be inspected after sever storm events. Remove all visible acculations of sediment on top of the mulch layer with a flat shovel. Stabilize eroded areas with appropriate geotextile and replant as required.

Just before new growth emerges in the spring, cut down standing stalks of herbaceous material to 12 inches. To eliminate competition from invasive plants and undesirable woody vegetation, selectively apply appropriate herbicide with a cut stump applicator or directed foliar sprays. Reseed and/or replant as required based on inspection findings. For woody material, inspect for pests and ice damage. Trees and shrubs should be pruned as needed every fall. The soil should be tested annually to ensure proper pH, and fertilizer should only be applied in the fall. Add mulch every spring to maintain design elevation.

FILTER STRIP CONSTRUCTION AND MAINTENANCE SPECIFICATIONS

Filter Strip Construction

Prior to the construction of the filter strip and permanent stabilization is established, all discharge should be diverted away from the filter strip. If this is not possible, the entire strip's width and length shall be protected by jute matting. In addition, during the construction of the filter strip, care must be taken to not compact the virgin soil. If compaction does occur, the soil must be tilled prior to permanent stabilization to restore lost infiltration capacity.

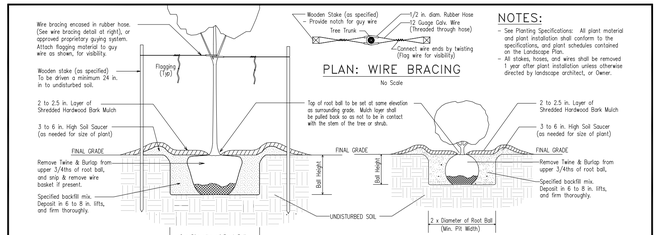
The filter strip should be excavated from virgin soil, if feasible. If the filter strip invert is in fill, a field change may be necessary. After excavation, the strip should be brought to final grade immediately and the erosion control matting installed per the plan(s). The matting shall be installed per the manufacturer's recommendation. The specified seed mixture is then placed and stabilized with mulch. To ensure proper germination of the seedbed, the guidelines within the Erosion Control Handbook should be followed. Upon periodic inspections, overseeding may be required for areas not stabilized properly. Erosion control matting shall be5150 Double Net Straw Blanket as manufactured by North American Green or approved equivalent.

Stabilization

Stabilization of the filter strip will require the use of Delaware seed mixtures as specified on the plan and found on pages 3.4.3-12 &13 in the Erosion and Sediment Control handbook. Mixtures specified are required to promote sedimentation and nutrientuptake. These seed mixtures shall be applied on top of the specified erosion control matting. The Erosion Control Handbook guidelines should be followed in the application, germination and maintenance of the establishment of the stabilization.

Standards for Filter Strip Inspection and Maintenance

There shall be semi-annual regular inspections of the facility once before new growth in the spring, and once at seed dispersal. The filter strip should also be inspected after severe storm events. The filter strip should be mowed regularly to maintain a dense stand. Mow no lower than 6 inches, or twice the quality storm event flow depth. A mulching mower should be used to ensure that nutrients are recycled, and that excessive clippings do not build up. The soil should be tested annually to ensure proper pH and fertility. Limeand fertilizer shall be applied to achieve proper pH and fertility. Fertilizer should only be applied in the fall.



PLAN: WIRE BRACING

No Scale

NOTES:

- See Planting Specifications: All plant material and plant installation shall conform to the specifications, and plant schedules contained on the Landscape Plan.
- All stakes, hoses, and wires shall be removed 1 year after plant installation unless otherwise directed by landscape architect, or Owner.

TYPICAL TREE & SHRUB PLANTING DETAILS

NO SCALE

APPLICATION NO. _____
TAX PARCEL NO. 10-050.00-011

PLAN PURPOSE

The purpose of this Landscape Plan is to provide planting for proposed Bioretention Facilities as part of a minor utility facility with a 999 s.f. storage / maintenance building and associated parking and access ways.

Signature of Owner / Developer Date

OWNER OR DEVELOPER:
Delmarva Power & Light Company
800 North King Street
Wilmington, DE 19801

GRAPHIC SCALE: IN FEET
0 8 16 24 32 40 80 120 FT.

BURCHAM & ASSOCIATES
LANDSCAPE ARCHITECTS & PLANNERS
311 South DuPont Road • Wilmington, DE 19805 • (302) 658-2827

REV. NO.	DATE	REVISION

LANDSCAPE PLAN

PROPOSED BIORETENTION FACILITIES PLANTING FOR SITE PLAN OF
1593 RIVER ROAD (a.k.a. Lot A, Getty Refining & Marketing Subdivision)
PREPARED FOR
BLOOM ENERGY
NEW CASTLE HUNDRED, NEW CASTLE COUNTY, DELAWARE

SURVEY BY: McBride & Ziegler, Inc.	SCALE: 1" = 40'
DESIGN BY: Gary L. Burcham	DATE: June 7, 2011
DRAWN BY: G.L.B.	SHEET NO. 1 OF 1
CHECKED BY: G.L.B.	